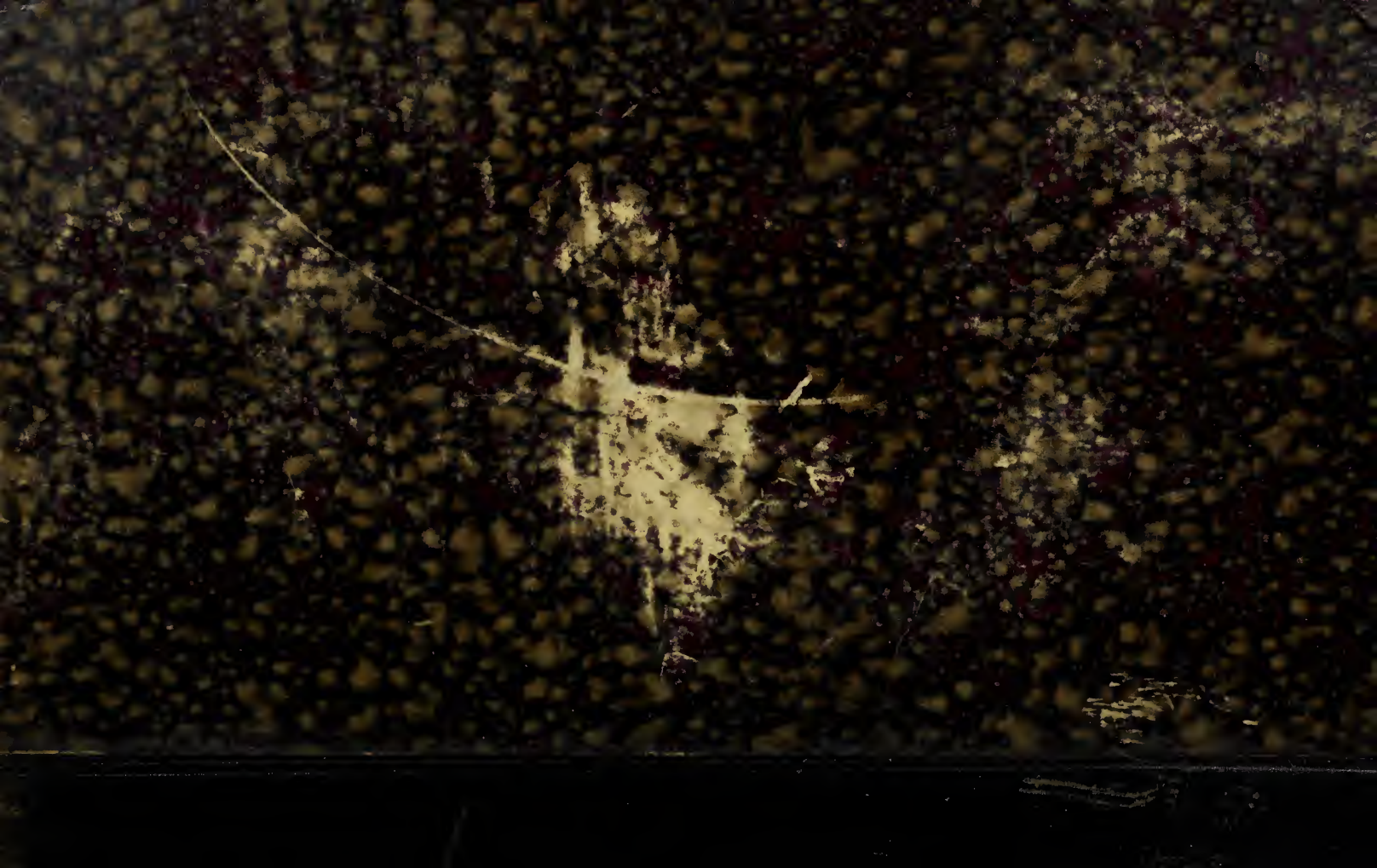


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Oregon Agricultural Experiment Station.

UNIVERSITY OF

Bulletin No. 15. January, 1892.

HORTICULTURE.

GEO. COOTE, Horticulturist.

The following Record and Notes relate to the growth of vegetables tested on our trial grounds during the year under like conditions of soil and treatment, the greater part of them being standard varieties well known to cultivators.

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

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1892.

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Test of Tomatoes.

The testing of tomatoes this season was to determine the earliness of varieties, the best manner of treatment and training, and also the effect of pruning. All plants were set out in soil of the same quality and were treated exactly alike. The ground had been well manured the previous fall, the manure plowed in, and allowed to lie all winter. In spring it was again plowed twelve inches deep, and then plowed a second time before the plants were set out. By this thorough cultivation the manure was well mixed with the soil, and by being plowed deeply, the roots of the plants were enabled to penetrate much deeper than they would otherwise have done; consequently, the roots found moisture which caused the plants to make a strong growth all through the dry season. The plants were cultivated between the rows every three weeks from the last of May until the last week in August.

After the fruit had set, six plants of each variety were pruned back to two joints above the fruit. Plants treated in this manner yielded much larger and better fruit, but not earlier, and the plants were comparatively free from small or stunted fruit. Plants that were allowed to grow at will, had a larger number of fruits to the plant, but smaller ones, thus proving that by keeping plants pruned back much better and more even fruit may be secured. But little difference could be noticed between the plants trailing on the ground and those trained to trellises, as the climate of the Willamette valley is dry during the fruiting season. The difference is not enough to pay for the expense of trellises.

38784

Result of Experiment with 55 Varieties of Tomatoes.

VARIETIES.	Date of Sowing	Date of Germinating	Per cent of Germination	Date of Pricking out	Date transplanted	Date of Blooming	Date of first ripe fruit	Date of edible maturity	Dat marketable maturity	Wt. of fruit frm 12 plants	Diameter of fruit	Length fruit
	Mar.	Mar.		Apr.	May	Jun				lbs oz	in.	in.
Acme-*Vaughan*	16	22	48	6	12	6	Aug 19	Aug 24	Aug 29	196 10	3	2
Advancer-*Vau*	16	22	70	6	"	3	" 18	" 22	" 26	16 11	2½	1⅞
Alpha-*Vau*	16	23	58	6	"	2	" 14	" 17	" 22	135 4	3	1¾
Acme-*Bowen*	16	23	36	6	"	6	" 19	" 24	" 30	193 5	2½	1¾
Chemin Market-*Bow*	16	24	86	7	"	3	" 13	" 20	" 27	129 9	2¾	2¼
Canada Victor-*Vau*	16	23	68	7	"	6	" 17	" 21	" 26	130 4	3½	1⅞
Cardinal-*Vau*	16	22	78	6	"	6	" 17	" 21	" 25	181 14	3	2
Cardinal-*Thorburn*	16	23	60	7	"	6	" 11	" 19	" 27	181 14	3¼	2¼
Dwarf Champion-*Bow*	16	23	60	6	"	6	" 12	" 19	" 23	83 4	1¾	1¾
Early Conqueror-*Bow*	16	22	70	6	"	6	" 14	" 18	" 22	304 4	3	2½
E. King Humbr't-*Thor*	16	27	100	7	"	7	" 9	" 15	" 22	125 10	1¾	2½
E. Hundred Days-*Bow*	16	23	57	6	"	6	" 28	" 29	Sep 2	100 ½	3	1½
Early Conqueror-*Vau*	16	22	72	7	"	4	" 11	" 15	Aug 20	280	2½	1½
Favorite-*Vau*	16	23	58	7	"	6	" 14	" 21	Sep 1	120 13	3	2¼
Haines No. 64-*Vau*	16	27	74	7	"	5	" 15	" 22	" 1	141 6	3½	2
Hathway Excel.-*Vau*	16	24	68	7	"	6	" 17	" 21	Aug 25	94 12	3	2
Impr. Large Yel.-*Vau*	16	22	18	6	"	3	" 11	" 20	" 26	125 10	2¾	1½
Improved Queen-*Vau*	16	23	98	7	"	7	" 14	" 19	" 26	54 10	2½	2
King of Earlies-*Vau*	16	23	86	7	"	3	" 12	" 17	" 23	131 4	2½	1½
Large Round Yel.-*Vau*	16	21	88	7	"	3	" 18	" 19	" 21	138 10	3¼	1¾
Livingstn Beauty-*Vau*	16	22	100	6	"	7	" 17	" 1	" 22	158 2	3	2⅛
Lorillard-*Vau*	16	23	54	7	"	3	" 19	" 25	Sep 1	91 1	2½	2
Livingston Stone-*Vau*	16	23	60	7	"	7	" 14	" 20	" 8	118 9	3	2¾
Large Yellow-*Bow*	16	22	56	6	"	3	" 17	" 20	Aug 23	76	2¾	1½
Livingstons Perf.-*Bow*	16	22	58	6	"	6	" 9	" 15	" 20	96 10	3	2
" Beauty-*Bow*	16	22	68	6	"	7	" 11	" 17	" 22	33 3	3	2¼
" Favorite-*Bow*	16	21	80	6	"	7	" 12	" 17	" 22	89 9	2¾	2
May Flower-*Vau*	16	22	48	6	"	3	" 14	" 29	Sep 1	95 12	2½	2
New Ignotum-*Vau*	16	24	80	7	"	6	" 19	" 24	Aug 29	113 13	3¼	2
" Golden Q'n-*Vau*	16	27	50	6	"	7	" 19	" 29	" 21	88 15	2½	2
" Dwarf Chmp.-*Vau*	16	23	94	6	"	7	" 22	" 28	Sep 5	33 9	2¾	2
" Peach-*Vau*	16	22	100	6	"	6	" 20	" 23	Aug 26	77 12	1⅞	1⅞
" Jersey-*Thor*	16	23	82	7	14	9	" 15	" 22	Sep 1	69 3	3¼	2¼
" Optimus-*Thor*	16	23	100	7	12	6	" 14	" 18	Aug 26	199 14	3	2
" Optimus-*Vau*	16	21	60	7	"	6	" 17	" 23	" 27	180 3	2¾	2¼
" Perfection-*Vau*	16	23	92	7	"	6	" 23	" 15	Sep 1	53 6	2¾	2⅛
Pear shaped-*Vau*	16	26	66	6	"	6	" 23	" 28	" 1	58 10	2	1½
Potato leaf-*Vau*	16	22	90	6	"	6	" 18	" 23	Aug 27	78	2⅞	2
Paragon-*Vau*	16	24	40	6	"	6	" 11	" 22	" 25	162 3	2¾	2
Puritan-*Thor*	16	23	90	7	"	6	" 16	" 21	" 31	26 9	3¼	2
Red Cherry-*Vau*	16	23	90	7	"	7	" 15	" 19	" 26	50 11	1	1
" Currant-*Vau*	16	25	68	7	"	3	July 22	July 29	" 3			
Red Pear shape-*Bow*	16	24	72	6	14	3	Aug 12	" 29	Sep 5	45 8	1⅛	1⅝
Scovill's Hybrid-*Vau*	16	21	60	6	12	6	" 16	" 23	Aug 26	76 2	2¾	2⅛
Turner's Hybrid-*Vau*	16	23	94	6	"	6	" 15	" 20	Sep 1	268 9	3¼	2½
Thor's Ing keepr-*Thor*	16	24	34	7	"	6	" 15	" 20	" 2	17 6	3	2½
Trophy-*Vau*	16	23	44	6	"	5	" 23	" 29	" 5	156 10	3½	2½
Trophy-*Bowen*	16	22	40	6	"	6	" 24	" 29	" 4	153 12	3	2
The Hovey-*Vau*	16	23	100	7	"	8	" 19	" 21	" 29	87 10	2¼	1½
Volunteer-*Thor*	16	23	88	7	14	6	" 13	" 20	" 29	156 12	2½	2¼
Volunteer-*Vau*	16	23	68	6	12	7	" 17	" 22	" 29	159 13	3	2
Vaughans Earl'st of all	16	23	100	6	"	3	" 12	" 16	" 22	69 14	2¾	1½
White Apple-*Vau*	16	23	84	7	"	6	" 15	" 21	Sep 1	53 6	1⅝	1⅜
Yellow Plum-*Vau*	16	22	96	6	"	6	" 14	" 20	Aug 25	20	¾	⅞
Carter's Seedless-*Sta*	16	23	97	7	"	6	" 23	Sep 2	Sep 9	96	3	2⅛

NOTE.—One hundred seeds of each variety were used in the experiments.

Description of Foregoing Varieties.

HATHWAY EXCELSIOR.—*Vaughan*. A medium sized tomato, regular in shape and fairly productive.

NEW PEACH.—*Vau*. A small, pinkish tomato, quite productive, and good for home use, and of excellent flavor.

PARAGON.—*Vau.* A rather large tomato, some of the fruit is slightly angular, fairly productive, solid.

EARLY KING HUMBERT.—*Thorburn.* An early variety valuable only for earliness. The fruit is angular and often hollow, color pink.

SCOVILLE'S HYBRID.—*Vau.* An excellent variety, smooth, and solid, color light red, fairly productive.

LARGE ROUND YELLOW.—*Vau.* Plant not a strong grower, fruit large, and productive.

LIVINGSTON'S BEAUTY.—*Vau.* Fruits uniform, smooth, a good variety, color pink.

TURNER'S HYBRID.—*Vau.* This is a good all round tomato, matures early and lasts well through the season, is hardy and a valuable variety, color pink.

HOVEY.—*Thor.* Not very productive, fruit medium in size, and smooth, light red.

ADVANCER.—*Vau.* A handsome fruit, but not productive with us, form angular, color bright red.

LIVINGSTON'S PERFECTION.—*Vau.* One of the best, fruit solid, not over productive, form regular, round and smooth.

LORILLARD.—*Vau.* Fruit somewhat ribbed, dark red color, solid, not productive.

NEW YELLOW PEACH.—*Vau.* An early variety, not productive, egg shaped, plant makes a small growth.

CARTER'S SEEDLESS.—*Station.* Fruit large, round, solid, with few seeds, highly flavored, not productive, color pink.

POTATO LEAF.—*Vau.* Fruit of medium size, smooth, plants moderately productive, color pinkish.

DWARF CHAMPION.—*Bowen.* Plant dwarf growing, leaves rough, stems short jointed, fruit of medium size, firm, smooth and regular, not very productive, color pink.

PEAR SHAPE.—*Vau.* Fruit pyriform, and not productive, color red.

TURNER'S HYBRID.—*Station.* Not so good in shape as the plant grown from the seed supplied by Vaughan.

IGNOTUM.—*Burpee.* Fruit large, solid, smooth, fairly productive, a good variety, color red.

TROPHY.—*Vau.* Plant a vigorous grower, fruit large, smooth, productive, is subject to rot, color red.

KING OF THE EARLIES.—*Vau.* Fruit irregular, of medium size, moderately productive.

MAY FLOWER.—*Vau.* Fruit slightly angular, large, and smooth, not productive.

HAINES' No. 64.—*Vau.* Resembles Cardinal, fruit large, light red, quite solid, a good variety.

VOLUNTEER.—*Vau.* Quite productive, of good quality and solid, an excellent variety.

ACME.—*Bowen.* A very smooth and uniform variety and of good quality, medium in size, red with a pinkish cast.

VOLUNTEER.—*Thor.* Resembles Paragon, moderately productive, solid, and of good quality, fruit round, color red.

OPTIMUS.—*Thor.* Plant a strong grower, fruit large, smooth, very showy, color red. A good variety although not quite so productive as some. It is worthy of a place.

LARGE ROUND YELLOW.—*Bowen.* Plant a moderately strong grower, fruit slightly ribbed and moderately productive.

EARLY CONQUEROR.—*Bowen.* Very productive, plant of medium growth, fruit large, good quality, slightly ribbed, color red.

CANADA VICTOR.—*Vau.* An early variety, of medium size, moderately productive, some of the fruit irregular, the majority smooth, color red.

LIVINGSTON'S FAVORITE.—*Bowen.* Fruits of good size, uniform, smooth, round, cell walls thick and firm, good quality, not very productive, red.

LIVINGSTON'S BEAUTY.—*Bowen.* A few days earlier than the above, fruit large, of good quality, color red.

LIVINGSTON.—*Bowen.* Resembles the above in every respect.

CARDINAL.—*Vau.* A strong grower, fruit slightly ribbed, light red color, a standard variety, productive.

CHEMIN MARKET.—*Vau.* Not over productive, plant a strong grower, fruit angular, color dark red.

THORBURN'S LONG KEEPER.—*Thor.* Fruit large, and smooth, fairly productive and of good quality, color red.

OPTIMUS.—*Vau.* Plant a very strong grower, fruit of average size, smooth, moderately productive, one of the best varieties.

HUNDRED DAYS.—*Bowen.* Not a very strong growing plant, fruit not of much value, very rough.

TROPHY.—*Bowen.* Fruit highly flavored, of good form and moderately productive.

YELLOW PLUM.—*Vau.* Fruit small, good for preserves, no productive.

RED CHERRY.—*Vau.* A small growing fruit, is a good variety where small varieties are wanted.

PURITAN.—*Thor.* An excellent variety, fruit large and very solid, not a heavy producer.

NEW JERSEY.—*Thor.* This is an excellent variety, smooth, solid, very showy, not over productive.

RED PEAR SHAPE.—*Bowen.* A small variety, too small for general use.

NEW IGNOTUM.—*Vau.* Resembles Ignotum of Burpee, is more prolific, evidently well selected.

FAVORITE.—*Vau.* This variety resembles Ignotum fruit, solid and of good quality, one of the earliest.

LARGE YELLOW.—*Bowen.* Plant an upright grower, fruit large, solid, few seeds, if yellow fruit is wanted this is a good variety, smooth.

CARDINAL.—*Thor.* Plant a strong grower, fruit smooth, of good quality, one of the best.

ACME.—*Vau.* Fruits of even size, slightly ribbed, of good quality.

WHITE APPLE.—*Vau.* Not a strong growing variety, fruit round, of medium size, not of much value.

LIVINGSTON'S PERFECTION.—*Bowen.* Fruit large, nearly round in form, of good quality, worthy of cultivation, although not quite so productive as some other varieties.

EARLY CONQUEROR.—*Vau.* Fruit not large, round, smooth, moderately productive, color red.

RED CURRANT.—*Vau.* This variety produces its fruit on long bunches like the currant, very handsome but too small for general use, is very productive.

NEW DWARF CHAMPION.—*Vau.* A stiff, short, jointed variety, fruit of medium size, color pink, smooth, round, quality good, not productive.

NEW GOLDEN QUEEN.—*Vau.* Fruit medium in size, solid, smooth, color a light yellow, not productive.

MATCHLESS.—*Burpee.* Fruit large, very irregular, solid, and has a large scar at apex.

The earliest varieties of tomatoes are: Livingston's Perfection, Early King Humbert, Livingston's Beauty, Cardinal, Livingston's Favorite, Alpha, and Large Round Yellow. There are only four days difference in the time of maturity of these, Early King Humbert being the earliest.

Experiment with Tobacco to Prevent the Ravages of Cut-Worms.

At the planting season we were troubled very much with the cut-worm—so much so that of the plants put out in the day we lost 25 per cent. in the night. We tried hand-picking every morning, but with very unsatisfactory results. To wage successful war with the cut-worm we took tobacco stems, cut into half-inch lengths; and after the soil had been cleared away from the stem of the plants to a depth of half an inch, a small quantity of tobacco was taken between the fingers and thumb and placed round the stem of the plants, and the soil replaced over the tobacco to the depth of from ¼ to ½ an inch. The juices of the tobacco, saturating the soil, made it very obnoxious to the cut-worm, and thus protected the plants from its ravages. Out of seven hundred plants so tested only one was destroyed by the worm after the tobacco was applied. But wherever the leaf of the plants touched the ground at a distance from the tobacco it was attacked by the cut-worm and cut off. The amount of tobacco placed around each plant was about ½ ounce. The total cost of the experiment on the 768 plants was 50 cents for tobacco and $4.00 for labor. Altogether the experiment was entirely satisfactory. It will be understood that the treatment was not pursued with a view of destroying the worm, but simply to protect the plants. The method here des ribed is highly recommended.

Cabbage.

Fall Planting of Early Winningstadt Cabbage.

The autumn planting of cabbage is of great importance as a supply for spring and early summer is thus provided. The time of sowing the seed at this station in the fall of 1890 for this purpose was Sept. 25, (would recommend a month earlier). The manner in which the plants were treated is as follows: After the plants had grown large enough to handle, they were pricked out four inches apart each way in a rich bed prepared for them in the following manner. First 6 inches deep of well rotted stable manure was spread to form the bottom of the bed, on this was placed 4 inches of very rich soil, being leveled off and made smooth, in this the plants were pricked out, care being taken to shade them from the bright sunshine for a few days. After which the plants began to make rapid growth, and on the 9th of November they were planted out to their permanent position in the open field, where they grew well and withstood the winter without injury. In the spring, after the soil had dried sufficiently to cultivate, the ground was kept well worked at convenient opportunities, never allowing the soil to become packed around the plants. After cultivation the plants made a much more vigorous growth, which they maintained during the spring. The first cabbage was cut June 18th. The heads were very solid and the average weight was 6½lbs. per head. In order to obtain good results by this fall planting the soil must be made very rich with manure and by very deep plowing.

Results of Testing Cabbage Seed in Kerlage Plates and in Sand.

VARIETIES.	KERLAGE PLATES. Av. Temp. 50°.			SAND. Av. Temp. 65o.		
	Last seeds germinated in days.	Percent of Germination.	Seedsman.	Last seeds germinated in days.	Percent of Germination.	Seedsman.
Bistol Drumhead	5	100	Brill	4	100	Brill
Extra Early Etampes	5	99	"	4	100	"
Early Jersey Wakefield	5	100	"	4	100	"
Fotter's Brunswick	5	97	"	4	95	"
Large Jersey Wakefield	5	100	"	4	98	"
Nonsuch	5	98	"	4	91	"
Premium Flat Dutch	5	97	"	4	98	"
Improved Late Flat Dutch	5	99	"	4	96	"
Perfection Drumhead Savoy	5	100	"	4	97	"
Early Summer	5	100	"	4	95	"
Newark Early Flat Dutch	5	95	"	4	94	"
World Beater	5	98	"	4	98	"
Succession	5	96	"	4	99	"
Vandergaw	5	95	"	4	90	"
Louisville Drumhead	5	92	"	4	94	"
Warner's Stone Mason	5	95	"	4	100	"
Novelty No. 9 Cauliflower	2	100	March	2	100	March
Improved Jersey Wakefield	5	85	"	4	93	"
Stone Mason Marblehead	5	78	Bowen	8	64	Bowen
German Fildercruat	5	57	"	8	56	"
Fotter's Drumhead	4	92	"	3	100	"
Green Globe Savoy	5	44	"	8	18	"
Extra Early Express	5	96	"	3	100	"
Early Drumhead	5	97	"	4	89	"
Early St. John's Day	5	97	"	4	96	"
Excelsior Flat Dutch	4	100	"	2	100	"
Drumhead Savoy	4	95	"	4	83	"
Early Large York	5	84	"	6	72	"
Henderson's Extra Early Summer	5	93	"	6	95	"
Premium Flat Dutch	4	100	"	3	100	"
Red Dutch	5	3	"	6	3	"
All Season	5	93	"	4	94	"
Early Dwarf Flat Dutch	5	81	"	8	69	"
Marble Mammoth Drumhead	5	88	"	4	100	"
Early Winningstadt	5	90	"	8	90	"
Improved Large Late Flat Dutch	5	97	March	4	100	March

NOTE.—100 seeds of each variety were tested.

For early use the Extra Early Express, Early St. John's Day, Early Large York, and Henderson's Extra Early Summer are recommended. For later varieties the Drumhead Savoy, Late Flat Dutch, Perfection Drumhead Savoy, and Green Globe Savoy are recommended.

The following seeds were received from Brill too late for planting out, but were tested for germination as per above list: Bristol Drumhead, Extra Early Etampes, Extra Early Wakefield, Large Early Wakefield, Early Summer, Succession.

Spring-Sown Cabbage.

Twenty-seven varieties of cabbage were grown for comparative tests. All varieties were sown in cold-frames and all did well except Red Dutch and Fottler's Drumhead, these two varieties being the lowest in per cent. of germination (seeds from Bowen). All varieties were tested in Kerlage plates and also in sand.

Table Showing the Results of Tests with Spring-Sown Cabbage.

VARIETY.	Name of Seedsman.	Date of Sowing.	Date of Planting Out.	Marketable Maturity.	Av. Weight in Lbs. per Head.	REMARKS.
Excelsior Flat Dutch	Bowen	Mar 31	May 14	Aug 27	9½	Large heads, firm, of good quality.
Premium Flat Dutch	Brill	Apr 1	" 15	" 26	9½	Heads of medium size, resembles the above.
Drumhead Savoy	Bowen	Mar 30	" 14	Sep 20	8	Good for winter use, leaves netted, a good variety.
Marblehead Mam. Drumhead	"	Apr 1	" 14	Aug 29	19	Very large, solid head, a good late variety.
Newark Flat Dutch	Brill	Mar 29	" 14	" 30	5	Solid, flat, heads small.
Perfection Drumhead Savoy	"	Apr 1	" 15	Oct 12	8	A good winter and late fall variety.
Early Large York	Bowen	" 1	" 14	Aug 24	7½	Heads conical, a second early.
Vandergaw	Brill	Mar 30	" 14	" 26	8½	Medium, flat head, good quality.
Fottler's Drumhead	Bowen	Apr 1	" 15	" 29	10	Medium-size heads, of good quality.
Early St. John's Day	"	" 1	" 14	" 24	5½	Solid heads, not large, very large leaves.
Improved Large Late Flat D.	March	Mar 30	" 14	Sep 10	14	A well selected variety with large heads.
World-Beater	Bowen	Apr 1	" 15	Aug 29	9	Resembles Flat Dutch.
True Early Wakefield	Brill	Mar 29	" 15	" 10	6	Heads small to medium, one of the early varieties.
Fottler's Brunswick	"	Apr 1	" 15	" 28	12½	Large heads, resembles Flat Dutch.
Early Winningstadt	Bowen	" 1	" 14	" 27	9	Heads conical, medium in size, good.
Stonemason Marblehead	"	" 1	" 14	" 29	5½	Heads not large, smooth, not of good quality.
Henderson's Ex. Early Sum.	"	" 1	" 14	" 24	14	A good variety, heads very solid, extra early.
Drumhead Savoy	"	" 1	" 14	Oct 14	7	Resembles Perfection Drumhead.
Early Express	"	Mar 31	" 14	" 25	2	Small variety with conical heads
Nonsuch	Brill	Apr 1	" 15	" 29	18⅝	Heads very solid, of extra quality.
German Feldkruat	Bowen	" 2	" 14	" 28	6	Heads conical, small.
All Season	"	Mar 31	" 14	" 27	8	Plants not true, seed very much mixed.
Louisville Drumhead	Brill	" 29	" 15	" 29	10	A strong variety, little over the medium size.
Early Newark Flat Dutch	"	" 29	" 15	" 22	5	An early variety with small round heads.
Green Globe Savoy	Bowen	Apr 4	" 15	Sep 6		Resembles Drumhead Savoy.
Improved Jersey Wakefield	March	Mar 29	" 15	Aug 9	6	No dif. noticed between this and True Ear. Jer. Wakef.
Red Dutch	Bowen	" 31	" 15	Oct 10	2½	Did very badly in every respect.

Peas.

Autumn-Sown Peas.

On the fourteenth of Nov. 1890 two varieties of peas were sown namely, New Alaska and First and Best. The last named germinated on Nov 28th and the former on Nov 30th.

The plants after growing about two inches out of the ground did not make much growth until the middle of Feb. and by the end of the month had made a growth of 4 inches. On March 1st and 2d the temperature fell to thirteen degrees above zero. This was followed by very bright sunshine each day after the frost, Earliest and Best lost forty five per cent of plants from the effect of the cold. New Alaska withstood the frost without any loss, thus proving itself the hardier of the two varieties. The remaining plants of First and Best had made a growth of 7 inches by March 18th and by April 2d began to show signs of bloom buds. On the latter date the plants were 13 inches high, the 8th of April the first bloom opened, on the 20th the plants were in full bloom, and the peas came to marketable maturity on May 12th. Height of plants 20 inches. Length of pod 3 inches, diameter ¾inch, seven peas in pod.

New Alaska made a growth of 6 inches by March 18th. On April 2d began to show bloom buds also. Height of plants at this date 8 inches. The first bloom opened on the 12th and the plants had attained a height of 12 inches, by April 20th they were in full bloom, and on May 20th the peas came to marketable maturity, height 3 feet, length of pod 3 inches, diameter ¾ inch, seven peas in pod. There was but little difference between the two varieties in productiveness. First and Best, was much the best for table use.

Spring-Sown Peas.

All varieties of peas were sown four feet apart receiving good cultivation between the rows. The following varieties require support: Champion, Stratagem, Telephone, Fall Sugar, Fall White, Marrowfat, Anticipation and Improved Dan O'Rook.

Result of Experiments with Peas.

VARIETIES.	Seeds From.	Date of Sowing.	Date of Germinating.	Date of Blooming.	Date of Edible Maturity.	Date of Marketable Maturity.	Date of Ripening.	Leng. of Pod in In.	No. Peas in Pod.	Lbs. to 100 Plants.	No. Lbs. to Rod.
American Wonder	O.A.C.	Apr 7	Apr 18	May 27	Jun 13	July 11	July 17	2½	7	5½	10
Blue Peter	Bowen	" 7	" 18	" 23	" 17	Jun 24	" 9	2½	7	1¾	7
Black-Eyed Marrowfat	"	" 7	" 20	" 20	" 6	" 16	" 31	3	8	5½	22½
Champion of England	O.A.C.	" 8	" 18	" 23	July 8	" 20	Jun 30	3	7	3⅜	19
Dwarf Sugr Edible Pod	Bowen	" 7	" 20	Jun 6	" 9	July 21	" 30	2½	6	3⅞	13¼
Champion of England	"	" 7	" 18	" 23	" 8	" 15	July 29	3½	8	4½	18
Everbearing	O.A.C.	" 8	" 18	" 6	" 8	" 14	" 27		6	1¼	12
Extra Early	Bowen	" 7	" 20	May 25	Jun 13	Jun 17	" 4	2½	7	2¾	9
Earliest of All	"	" 7	" 20	" 25	" 12	" 18	" 9	3	7	3¼	16
Eugene	O.A.C.	" 8	" 20	Jun 23	July 6	July 20	" 29	2½	6	3	24¾
Improved D. O. Rook	Bowen	" 7	" 18	" 25	" 11	Jun 17	" 7	2	7	1½	8
Laxton's Alpha	"	" 7	" 20	May 24	Jun 13	" 19	" 9	2½	7	3¾	16½
McLeanes' Ear. Adv'cer	"	" 7	" 20	" 24	" 13	" 19	" 10	3	7	3¼	16
McLeane's Advancer	O.A.C.	" 8	" 20	" 25	" 15	July 15	" 21	3½	6	2⅜	20
New Alaska	"	" 8	" 20	" 21	" 17	" 12	" 27	2	7	2⅜	13¾
Stratagem	"	" 8	" 23	Jun 24	July 9	" 21	" 30	4½	7	1¾	13½
Tom Thumb	"	" 8	" 18	May 26	Jun 10	Jun 16	" 7	2	6	1¼	10
Telephone	"	" 8	" 20	" 27	" 18	July 13	" 20	4	8	2⅜	18¾
Fall Sugar	Bowen	" 7	" 20	Jun 28	July 10	" 15	" 20	4	8	4⅞	20
Fall White Marrowfat	"	" 7	" 20	" 25	" 13	" 21	" 30	4	8	5	22
Anticipation	O.A.C.	" 8	" 23	" 17	" 8	" 17	" 29	4¼	7	1¾	24
Premium Gem	Bowen	" 7	" 20	May 23	Jun 11	Jun 18	" 11	2½	6	¼	18¼
Yorkshire Hero	"	" 7	" 20	Jun 25	July 6	July 15	" 29	3½	7	5	20
Veitche's Perfection	O A.C.	" 8	" 23	" 24	" 9	" 21	" 30	3	6	4⅔	5

Lettuce.

The seed was sown in drills in the open field on April 14. All varieties germinated well. After the plants were large enough to handle, they were thined out to 8 inches apart in the row. The rows were set out 4 feet apart and the ground was kept well cultivated during the season of growth. On the soil which had received the largest proportions of manure, the plants made a much larger growth; which demonstrates that the lettuce needs abundant food.

By this heavy application of manure the season is prolonged and the plants do not run to seed so quickly.

VARIETIES.

GIANT WHITE CROSS.—Made a very strong growth, large dark green outside leaves, head loose, becoming more solid as the season advances.

San Francisco Market.—Compact grower, early.

White Paris Cross.—More compact heads than Giant White, leaves folding in over each other so that they form a large solid head, very crisp and sweet, a valuable variety, long season.

Longstanding.—Head round, moderately firm, does not run to seed very readily.

Hanson.—This is a long season variety with compact heads, leaves curly, color light green.

Prize Head.—Medium size heads with curled leaves.

Philadelphia Butter.—Heads open, yellowish green, leaves plain, runs to seed very quickly.

Tennis Ball.—A very valuable variety with small solid heads, sweet and tender.

Golden Hearted.—Heads resemble Prize Head.

Early Tennis Ball.—Similar to Tennis Ball in every respect.

Paragon.—Very compact head, valuable variety.

Large Drumhead.—Made a large growth, with very loose heads.

Deacon.—Small, firm, round heads, leaves smooth.

Simpsons' Early Curled.—Heads round and solid, color light green.

Simpson's Early Black Seeded.—Much like the above, but a few days earlier, inclined to rot.

Seeds of the following varieties were planted April 14, 1891:

NAME.	Source.	Date of Planting.	Date of Germinating.	Date of Edible Maturity.	Date of Marketable Maturity.
Deacon	Bowen	Apr. 23	Apr. 23	June 21	June 27
Early Paris	"	" 23	" 23	" 23	" 8
Early Tennis Ball	Station	" 14	" 23	" 19	" 23
Early Curled Silesia	Bowen				
Golden Hearted	Station	Apr. 14	" 28	" 20	" 25
Grant White	Bowen	" 14	" 23	" 29	" 8
Hanson	"	" 14	" 24	" 30	" 8
Large Drumhead	Station	" 14	" 28	July 2	July 9
Long Standing	"	" 14	" 29	" 10	" 18
Paragon	"	" 14	" 23	" 10	" 16
Prize Head	Bowen	" 14	" 23	" 14	" 19
Philadelphia Butter	"	" 14	" 28	" 13	" 17
Simpson's Early Curled	"	" 16	" 23	" 10	" 16
Simpson's Black Seeded	"	" 14	" 28	" 6	" 16
Golden Ball	N.B.G*	" 15	" 28	" 6	" 12

*Northrupt, Breslau, Goodwin & Co.

Radish.

NAME.	Source	Date of Planting.	Date of Germinating.	Date of Edible Maturity.	Date of Marketable Maturity.	Length in In.	Diam' in In.
Charteris	Station	Apr. 15	Apr. 23	June 2	June 8	12	1½
Improved Charteris	Bowen	" 15	" 23	" 6	" 11	9	1¾
Olive Rose	Station	" 15	" 23	" 8	" 13	3½	2
Mammoth California	Bowen	" 15	" 23	"	"		
Long Scarlet	"	" 15	" 23	" 3	" 8	12	¾
Golden Globe	Station	" 15	" 28	" 6	" 10	6	2½
Chinese Rose	Bowen	" 15	" 23	" 9	" 15		
French Breakfast	"	" 15	" 23	" 9	" 16	3½	2

REMARKS.

CHARTERIS.—Of excellent quality.

IMPROVED CHARTERIS.—Identical with the above.

OLIVE ROSE.—Good for table.

MAMMOTH CALIFORNIA.--Made strong top growth but no bottom.

LONG SCARLET.—Very mild and of good quality.

GOLDEN GLOBE.—Very tender—very much like a turnip.

FRENCH BREAKFAST.—Wrongly named. Resembles Olive Rose.

Of the above list of radishes the Charteris is the most valuable. Average length of roots, 12 inches, 1½ inches in diameter, and of excellent quality. There was not enough difference between Improved Charteris and Charteris to distinguish them.

Cauliflower.

VARIETIES.	Name of Seedsman.	Date of Sowing.	Date of Germination.	Date of Edible Maturity.	Date of Marketable Maturity.	Av. No. Lbs. Per Head.
American Erfert	Brill	Mar 20	Mar 24	July 19	July 22	4½
Early Snowball	Bowen	" 20	" 25	" 19	" 22	6
Early White French	"	" 20	" 23	" 21	" 23	6½
Extra Early Dwarf	"	" 20	" 23	" 20	" 24	5
Novelty No. 9	March	" 20	" 23	" 19	" 22	6
Carter's Extra Early Autumn Giant	Carter	" 25	" 29	Oct. 13	Oct. 18	2½

Remarks on Cauliflower.

EARLY SNOWBALL.—*Bowen.* The heads were loose, with a yellowish color, short stem, does not produce many leaves.

EARLY WHITE FRENCH.—*Bow.* Heads globular and quite compact, with large leaves. The heads are perfectly white. Good.

EXTRA EARLY DWARF.—*Bow.* The plants did not resemble the variety, as they were long-stemmed, with rather loose heads, quite white.

AMERICAN ERFERT.—*Brill.* Beautiful, compact heads, quite white, with very short stems. Very good.

NOVELTY No. 9.—*March.* This variety was grown from seed received from H. A. March, Fidalgo, Washington. The heads were very compact and of excellent quality.

LE NORMAND.—Short-stem variety with compact heads.

CARTER'S EXTRA EARLY AUTUMN GIANT.—*Carter.* A valuable autumn variety, coming into use after all others are out of season. Good.

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Oregon Agricultural Experiment Station.

Bulletin No. 16. February, 1892.

AGRICULTURE.

H. T. FRENCH,
Agriculturist.

C. D. THOMPSON,
Foreman of the Farm.

Notes on Varieties and Yield of Wheat.

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

H. R. CLARK, Manager,
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Notes on Wheat.

Of the varieties of wheat tested last year, and reported upon in Bulletin No. 8, a number of the most promising sorts were selected, and grown in larger area, that a test of the yield might be made. The plats, where a test of the yield was made, were not less than one twentieth of an acre in size, and the most of them contained ¼ of an acre. In some instances, we did not have sufficient seed to sow the full ¼ acre.

The larger plats were located on ground, which had grown a crop of ensilage corn. The corn was cut for the silo and the ground plowed and harrowed before sowing the wheat. No manure was applied to these plats. On some smaller plats, where the wheat was put in by hand, fine manure was harrowed into the ground before sowing. This was applied mainly for its mechanical effect upon the soil, to keep it from baking so hard in the spring. In this the top dressing proved an advantage, for the ground did not pack down as firmly as it had done the year before, when no mulch was used. The wheat, in the larger plats, was sown with the Hoosier force feed drill, at the rate of 1½ bushels per acre. The seed was treated with a vitriol solution, to prevent the growth of smut, which does so much damage if no fungicide is used. In one instance white winter wheat was sown without treating with vitriol, and it was not worth harvesting, while seed from the same lot was vitroled and no smut appeared. While some of the varieties were not entirely free from smut yet, for the most part, the wheat which was vitrioled escaped the ravages, of this fungus.

As to sowing wheat after corn there is much discussion just at present. It has been grown in this way, on the College farm, for the past two years, giving very satisfactory results indeed. Wheat sown in a field after ensilage corn, yielded 40 bushels per acre; while that sown in the same field after oats, did not yield over 25 bushels per acre.

Whether it will pay to grow a crop of corn or some other hoed crop, on the summer fallow, and thus get some returns for the labor expended in cultivation, is an important question. Wherever it has been tried in this valley, so far as I am aware, the yield has increased rather than diminished, under such treatment. In other words, there has been an increase in the yield of wheat due probably, to the better condition of the ground after the thorough cultivation, which it received from tending the corn. The matter of shading the ground with a crop, rather than leaving it exposed to the direct rays of the sun, during the hot dry months, is another reason which should not be omitted. The only question is, can the corn crop be profitably handled after it is grown? This belongs to another branch of farming; but we believe it can be so managed, by means of the silo, and it will be the work of a future Bulletin to show this. We believe the bare summer fallow should be a

thing of the past, in the Willamette valley. It is not rest, that the land needs, but a better system of cultivation.

Very full notes were taken by C. D. Thompson, foreman of the farm, during the season's growth, and upon the character of the grain after threshing. These have been condensed under each variety, and are found on the final pages of the Bulletin, and in the table.

The season was very favorable for an extreme growth of straw, and in some instances the yield was very satisfactory. Some of the varieties would have done better in yield probably, had they been pastured off during the winter and early spring.

Two varieties of imported wheat were sent to the Station, for trial last season. They were called the Hybrid Dattel, and Hybrid Lamed, both having been imported from France, by the U. S. Department of Agriculture. The Hybrid Dattel is a very promising variety, both in yield and in quality. It is a very heavy, white wheat, uniform in size, and the kernel is very hard and flinty.

The Hybrid Lamed, is an Amber wheat, and not as uniform in the size of the kernel or in the quality of the grain, as the Dattel. It did not yield as well as the Dattel. Larger areas of these varieties will be sown, that a more extended trial may be made, before recommending them to the farmers of this state. One of the varieties, will probably prove a very good one for this climate and soil.

The quality of the grain, which has been grown from imported seed, so far as the appearance indicates, is very much superior to the original; showing that wheat finds, in this portion of the state at least, a very congenial soil and climate.

The Amber wheats are generally heavier than the white varieties, as seen in the table. Were it not for the fact that they are rated two or three cents per bushel less in the market, than white wheat, they would be grown more extensively. Some of the Amber varieties are very fine in quality, yield well, and would prove more hardy than some of the white varieties; yet the farmer is loth to grow them, because of the reduced price. Upon inquiry of some of the leading millers, I find that it is desirable to mix, a portion of red wheat, with the valley white wheat, to make the best quality of flour. Why not encourage the farmers, by paying the full market price, to grow this more hardy wheat, and thus meet the requirements for the manufacture of first quality flour.

In receiving a large number of inquiries for wheat to sow on trial, only a few have desired amber wheat. If it is speculation on the part of buyers, to keep the price of red wheat down, it is time the farmers were awake to the matter; and on the other hand, if the amber wheat is not really desired, and does not make as good flour, let us know that fact.

No. 10, Beryl, Chili, Beal, and Northcolis White, are the best varieties of white wheat, which have been grown on the experimental grounds for two succeeding years. Over a hundred samples of these varieties, have been sent to farmers in the state for trial.

Goose wheat is a large, coarse variety, valued in some localities for feeding purposes. It gives a larger yield than the common wheat and makes a

1
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good grain to grind for stock. It is also ground into meal, which is valued by some in making mush for the table. A head of this wheat is shown in the cut No. 3.

Seven headed wheat is a variety of wheat, deriving its name from the peculiar branching nature of the head. It is not valued for milling purposes; but is grown in large quantities in some localities for stock feed. A head is shown in cut No. 4.

Centennial and Trap are, so far as we can discover, one and the same variety known under different names. Heads of these varieties numbered 5 and 6 appear in the cuts.

No. 10, Beryl, Chili, Beal and Northcolis White also appear in the cuts numbered 7, 8, 9, 10, 11, in the order named.

After two years trial, the following conclusions present themselves, as reasonably well established.

1.—That the varieties of wheat imported from foreign countries, and from the Eastern states, have improved in this soil and climate.

2.—That of the 64 varieties tested, only five or six, are superior to the varieties already grown in the state.

3.—That wheat does well when grown after corn, which has been thoroughly cultivated.

4.—That the Amber wheats are generally heavier than the white wheats, and do well in this soil and climate.

Description of Varieties.

Velvet Chaff. Heads loose, uneven, drooping, chaff red, bearded; straw erect, 46 inches high; grain dark amber, good size, plump and flinty, shatters easily.

Red Fultz. Heads rather loose, uneven, well filled, drooping, chaff red, has short awns; straw blue, stands erect, 52 inches high; grain medium size, not all plump, dark amber color.

Nigger. Heads loose and very uneven, chaff white, bearded; straw blue, does not stand up well, 54 inches high; grain long, uneven, slightly shriveled, shatters easily, amber color.

High Grade. Heads uneven length and rather loose, bending over some, chaff white, stem blue; straw fallen, 52 inches in length; grain medium long, pointed, quite plump, very light amber.

Hindostan. Heads loose; medium length, chaff red, bearded: straw blue, stands erect, 52 inches high; grain easily shattered, long, uneven berry, amber color.

Mealy. Heads medium length, rather uneven; compact and well filled, chaff white, awnless; straw white, very soft and erect, 51 inches high; grain badly smutted, small berry, plump, amber color.

Fulcaster. Heads rather short, loose and uneven, chaff white, bearded, does not cover the grain, stem blue, straw weak and fallen, 50 inches in length; grain good size, uniform, amber color.

Ontario Wonder. Heads good length, loose, uniform in size, and well

filled; chaff redish; straw white, brittle, crinkled, 50 inches high; grain short, plump and uniform, light amber color.

Martin's Amber. Heads medium length, rather loose, uneven, but well filled; chaff white, awnless; straw white, soft and erect, 46 inches high; grain medium size, plump and white.

Raub's Black Prolific. Heads medium length, compact, rather uneven, chaff red, bearded; stem blue, straw erect, 53 inches high; grain amber color, uniform and plump.

Golden Cross. Heads from one to four inches long, compact, chaff red, bearded; stem blue, straw erect, 53 inches high, grain amber color, plump and uniform.

Flourspar. Heads good leugth, loose, chaff white; straw white, fine, stiff, 48 inches high; grain rather small, uneven, mixed in color and quite smutty.

French Imperial. Heads very long and loose, chaff white; straw white and soft, badly fallen, 51 inches in length; grain very dark amber, uneven in size and smutty.

German Emperor. Heads very uneven and loose, chaff red, short awns; stems blue, straw stiff, 43 inches high; grain amber, uniform and plump.

Sardonyx. Heads good length, quite uniform; very loose, chaff white; straw white, soft, erect, 52 inches high; grain light amber, large and plump.

Chrysolite. Heads uniform and compact, chaff white; straw white, soft and fallen, 41 incees in length; grain white, uneven in size, plump, and a little smutty.

Northcolis Amber. Heads good length and compact, quite uniform in size, chaff white; straw white, coarse, and fallen; grain amber color, good size, uniform and plump.

Sardins. Heads medium length, uniform, loose, chaff white; straw white, rather fine, soft and fallen some, 51 to 62 inches high; grain badly smutted, good size, uniform, dark rusty amber, easily shattered.

Red Club. Heads very short and compact, chaff red; straw stiff, 46 inches high; grain short, plump, very badly smutted.

Jasper. Heads long, slim and loose, chaff amber, bearded; straw coarse, soft, badly fallen, 60 inches long; grain amber color, good size, plump and uniform.

Northcolis White. Heads good length, uniform, compact, chaff red; straw white, medium size, erect, 56 inches high; grain white, large, uniform, plump berry. One of the best.

Emerald. Heads long, loose and drooping, chaff dark amber; straw white, medium size, fallen some, 55 inches long; grain shatters, light amber color, long uneven berry.

Willits. Hybrid between wheat and rye. Heads long and compact. In many instances there are five grains in the rank. Chaff white; straw bluish tinge, coarse and stiff, 55 inches high; grain amber color, shatters easily, uneven in size.

Johnson. Heads medium length, quite compact and uniform, chaff white, bearded, some of the awns fall off when ripe; straw bluish tinge,

coarse and stiff, 55 inches high; grain large, white with some grains light amber, uniform in size.

No. 10. Heads long, large, compact, heavy, chaff white; straw white, medium coarse, fallen on account of storm and its extreme growth, it being 68 inches high; grain good size, white, plump and uniform. One of the best varieties.

Clawson. Heads long, loose, chaff red; straw white, soft and weak, badly fallen, 60 inches high; grain good size, long, plump, white, shatters easily,

Assimboia Fife. Heads small and uneven, chaff white; straw white, fine and fallen, 52 inches long; grain light amber color, small, plump, and smutted some.

Chili. Heads good length, quite uniform, rather coarse, chaff white; straw white, coarse, stiff, stands erect 60 inches high, grain white, large berry, uniform and plump. One of the best.

Wheat from Warren Co., Pa. Heads good length, rather even, chaff white; straw bluish, 48 inches high, stiff and coarse; grain white,

Granite. Heads very uneven, compact, chaff red; straw yellowish, fine, soft, quite stiff, 50 inches high; grain uneven size, plump, white with few amber-colored grains.

Basalt. Heads quite uneven, compact, chaff red; straw white, fine, erect, 56 inches high; grain small, rather long, dark amber color.

Missoyen. Heads medium length, flat, very compact, chaff amber, very heavily bearded, some of awns are 5 inches long, a portion of awns drop off when grain is ripe; straw white, coarse, solid almost to bottom of stalk, straw badly fallen, 60 inches long; grain white, very large berry and very hard or flinty.

Trap. Heads very long and flat, compact, chaff white, heavily awned but awns drop when grain is ripe; straw white, coarse, stiff, 70 inches high; grain white, very large, long berry, and not very hard.

Foisy. Heads good length, quite uniform, compact, chaff amber; straw white, medium size, soft, 60 inches high.

Beryl. Heads good length, compact and quite uniform, chaff white; straw coarse, soft, fallen some, 54 inches long; grain white, short, plump berry, little uneven and some smutty.

Amethyst. Heads small, and short, chaff white; straw yellowish, fine, soft, erect, 48 inches high; grain small and uneven, mixed in color—amber and white.

Platinum. Heads small, medium length and loose, chaff white; straw white, fine, soft, erect, 50 inches high; grain small, uniform, plump, white.

Dominion. Heads usually long, medium size and loose, chaff amber; straw white, fine, soft and weak, 54 inches high; grain dark amber, small and plump.

Porcelain. Heads good length, medium size and rather loose, chaff white; straw white, coarse, soft, 55 inches high; grain rather small and mixed amber and white.

Dallis. Heads medium length, campact, chaff amber; straw rather coarse, soft, erect, 52 inches high; grain medium size, uneven, mixed amber and white.

Russian. Heads very uneven in length, small and loose, chaff red; straw rather fine, erect, 55 inches high; grain uneven, plump, amber color.

Silica. Heads unusually good length, loose, chaff white; straw white, fine, erect, 56 inches high.

Atlanti. Same as Messoyen.

Wonder of the World. Heads medium length, flat, compact, very

heavily bearded; straw white, good size, weak, fallen very badly, 63 inches long; grain very uneven, long, flinty berry. This variety does not stool well.

Goose Wheat. Heads large, long and loose, bearded, awns fall off when grain ripens; straw white, medium size, bending with the heavy heads. Straw 58 inches high; grain white, very long, some of the kernels being ½ inch in length. Does not stool very much.

Seven-Headed Wheat. Heads large, club-like, made up of several branches or spikelets; straw very coarse and stiff, bending some with the very heavy heads; grain short, plump, uniform, white.

Ruby. Heads usually very long, pointed and loose, chaff white; straw medium size, stiff, erect, 60 inches high; grain short, very plump, amber color, shatters easily.

Centennial. Same as Trap.

Hornblende. Heads small, medium length, pointed, loose; straw fine, soft, weak, 64 inches long; grain small, uneven, white and flinty.

Hybrid Dattel Imported. Heads medium length, rather compact, chaff brownish; straw yellowish, medium size, soft, erect, 53 inches high; grain white, good size, short, plump and uniform. This will prove a good variety we think.

Hybrid Lamed. Straw and chaff resemble the last variety; heads a little longer and more compact; grain amber color and about the same shape as the other.

White Russian. Heads uneven length, rather compact, chaff red; straw white, soft and weak; grain amber color. Not a desirable variety.

Saskatchewan. Heads small, long and pointed, chaff red; straw very white, fine and soft, 55 inches high; grain short. small, even size, plump, light amber color

Gneiss. Heads small and short, chaff white; straw white, fine, soft, fallen very badly, 46 inches in length; grain medium size, white and plump.

Chalcedony. Heads small and short, chaff white; straw white, soft, badly fallen, 50 inches in length; grain medium size, white and plump.

Andriala. Heads medium length, rather compact, chaff amber, bearded; straw fine, soft, fallen some, 46 inches long; grain exposed in the head. short, uneven berry and plump.

Sapphire. Heads medium length, loose and uneven, chaff red; straw white and rather coarse, 53 inches high; grain shatters, berry long, white, and not very uniform in size.

Meekins. Heads good length but loose, chaff white; straw white, 58 inches high; grain exposed in head and shatters very easily, dark amber color and uneven.

SPRING VARIETIES.

Canada. Heads rather short, medium compact, chaff white; straw yellowish, medium fine, soft, 35 inches high; grain white and amber mixed, very uneven, plump.

Bli de Bordeaux. Imported. Heads medium length, good size, compact, chaff amber; grain uneven size and shrunken, amber color with few light-colored grains. Thirty-eight inches high.

Defiance. Heads medium length, some very long and loose, chaff white; straw white, 34 inches high; grain uneven size, plump, white.

New York Spring. Heads very long and loose, chaff white; straw yellowish, 36 inches high, amber grain.

Some very large grain was received from Baker City, Oregon, which proved to be Goose Wheat.

Table Showing Yield, Weight Per Bushel, &c.

NAME OF VARIETY.	No. of Plat.	Date of Sowing.	Date of Ripening.	Yield in Bu. Per Acre.	No. of Lbs. Per Bushel.	REMARKS.
White Russian	1	Dec. 1	July 22	28⅔	61½	¼ acre plat.
Saskatchewan	2	" 1	" 22	29⅓	63½	" " "
German Emperor	3	Nov. 20	" 16	26.2	64½	" " "
Mealy	4	" 21	" 16	33¾	63	" " "
Martin's Amber	5	" 21	" 16	29.4	63¾	" " "
Raub's Black Prolific	6	" 20	" 16	22.4	64½	" " "
Fulcaster	7	" 21	" 16	23⅓	66	" " "
Hybrid Dattel	8	Dec. 1	" 22	27⅓	62¾	½ " "
French Imperial	9	Nov. 20	" 16	14	60½	¼ " "
Golden Cross	10	" 20	" 16	52.4	64	" " "
High Grade	11	" 21	" 15	30	62½	" " "
Red Fultz	12	" 21	" 16	30⅔	64	" " "
Hindostan	13	" 21	" 15	22⅔	65	" " "
Nigger	14	" 2	" 18	22⅔	65	" " "
Ruby	15	" 22	" 20	46⅔	63½	1-13 " "
Hybrid Lamed	16	Dec. 1	" 22	29⅓	61½	⅛ " "
Velvet Chaff	17	Nov 21	" 18	26⅔	66	¼ " "
Ontario Wonder	18	" 21	" 16	25.86	63¾	" " "
Chili	19	" 28	" 18	44.8	64½	1-16 " "
Atlanti	20	" 19	" 21	38	64¼	1-20 " "
Sardonyx	21	" 22	" 17	37		
Centennial	22	" 19	" 21	40	59¼	1-20 " "
Flourspar	23	" 22	" 17		63½	Small plat.
Clawson	24	" 18	" 17	41⅓	63¾	1-20 acre plat.
No. 10	25	" 19	" 18	58	63¾	" " "
Andriala	26	" 12	" 18	.....	.....	
Dominion	27	" 13	" 18	.....	.....	
Chrysolite	28	" 12	" 17	.....	.....	
Gneiss	29	" 10	" 18	.....	.....	
Chalcedony	30	" 10	" 18	.....	.....	
Jasper	31	" 12	" 18	.....	.....	
Willits	32	" 15	" 18	.....	.....	
Northcolis Amber	33	" 12	" 18	.....	.....	
Seven-Headed	34	" 19	" 21	.....	.....	
Sapphire	35	" 12	" 18	.....	.....	
Gypsum	36	" 10	" 17	.....	.....	
Northcolis	37	" 12	" 17	.....	.....	
Red Club	38	" 12	" 18	.....	.....	
Trap	39	" 15	" 21	.....	.....	
Beryl	40	" 12	" 12	.....	.....	Plats too small to warrant an estimate of the yield.
Platinum	41	" 12	" 12	.....	.....	
Assiniboia Fife	42	" 22	" 22	.....	.....	
Basalt	43	" 10	" 10	.....	.....	
Amethyst	44	" 10	" 10	.....	.....	
Porcelain	45	" 13	" 13	.....	.....	
Sardins	46	" 13	" 13	.....	.....	
Johnson	47	" 15	" 15	.....	.....	
Granite	48	" 10	" 10	.....	.....	
Hornblende	49	" 19	" 19	.....	.....	
Wonder of the World	50	" 19	" 19	.....	.....	
Beal	51	" 19	" 19	.....	.....	
Foisy	52	" 22	" 22	.....	.....	
Goose	53	" 19	" 19	.....	.....	
Meekin's	54	" 12	" 12	.....	.....	
Silica	55	" 22	" 22	.....	.....	
Dallis	56	" 10	" 10	.....	.....	
Missoyen	57	" 15	" 15	.....	.....	
Bli de Bordeaux	58	Apr. 30	Aug. 17	.....	.....	Spring Wheat.
New York Spring	59	May 13	" 17	.....	.....	" "
Toronto Canada	60	" 2	" 16	.....	.....	" "
Defiance	61	Apr. 30	" 17	.....	.....	" "
Emerald	62	Nov. 12	" 17	.....	.....	Winter Wheat.
Lost Nation	63	" 28	July 20	.....	.....	" "
Russian	64	" 12	" 20	.....	.....	" "

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Oregon Agricultural Experiment Station.

Bulletin No. 17. February, 1892.

CHEMISTRY.

G. W. SHAW, Chemist.

DUMONT LOTZ, Assistant Chemist.

SUGAR BEET.

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

H. R. CLARK, Manager,
AGRICULTURAL COLLEGE PRINTING OFFICE.
CORVALLIS, OREGON:
1892.

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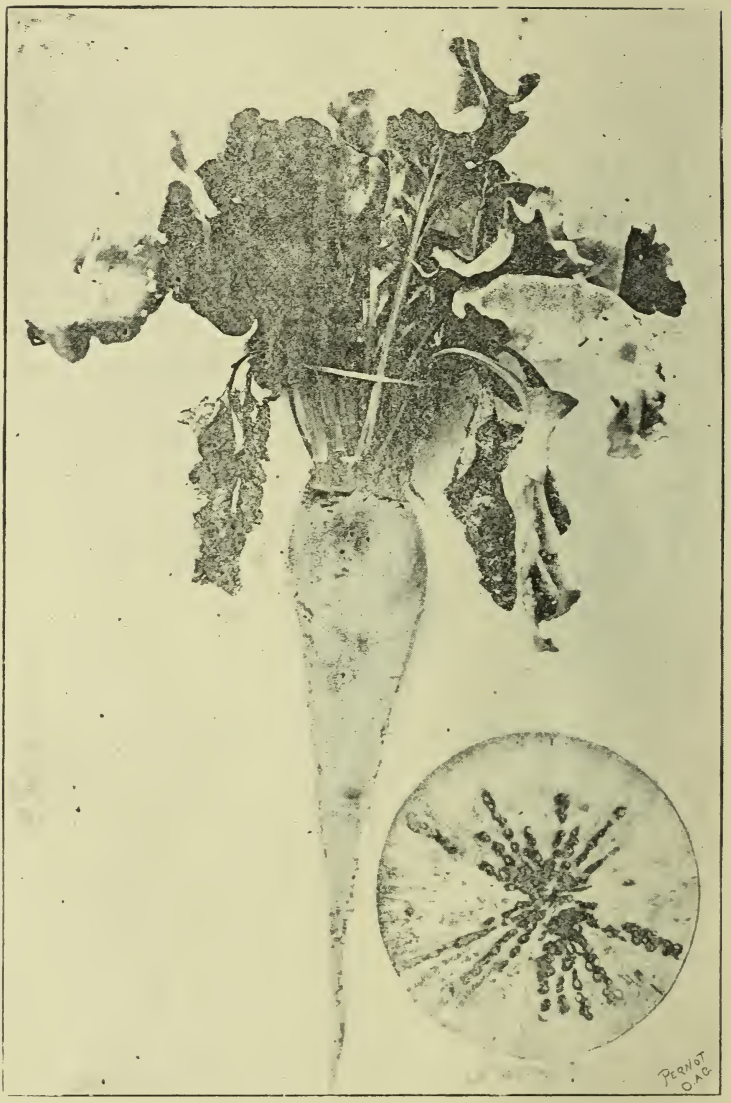


Plate I.

Sugar Beet Experiments of 1891.

It has been known for a long time that beets contained sugar, but the fact that beets could successfully compete with the cane for sugar production is of comparatively recent origin. At first only about three per cent. of crystallized sugar could be obtained from the beet, although it contains from six per cent. to seven per cent.

The demands of the Napoleonic wars on the one hand and human needs on the other concentrated attention upon the beet as a sugar producer till by selection, cultivation, and improved methods of work in extracting and purifying sugar, more than one-half the sugar used is manufactured from beets. The per cent. of sugar, in the mean time, has been increased to an average of about 12 per cent., and in some cases the saccharine content even extends to 25 per cent.

The beet is a hardy biennial plant indigenous to Southern Europe, and more recently introduced into Canada and the United States. Internally the beet root is built up of a large number of concentric rings formed of a much larger number of small cells, each of which is filled with a watery solution of many bodies other than sugar. These contain a number of crystalloid salts, as the phosphates, malates, oxalates, and of calcium, but the salts of potash being by far the most prominent. The juice also contains a number of colloid substances, as the albuminous and pectinous compounds. The sugar present in fairly ripe beets is crystallizable and identical with cane sugar. Plate I, frontispiece, shows a cross-section of the beet which shows the general structure aud arrangement of cells.

In order that farmers in this State may have a better idea concerning the sugar production of the world the following table is inserted.

Sugar Supply of the World.

SOURCE.	Kind.	Tons 1890-91	Tons 1891-92
Germany	Beet.*	1,331,965	1,280,000
Austria	Beet.	778,873	850,000
France	Beet.	694,537	750,000
Russia,	Beet.	524,000	530,000
Belgium	Beet.	200,000	295,000
Holland	Beet.	61,307	50,000
United States	Beet.†	.....	13,100
Other Countries	Beet.	80,000	61,900
Miscellaneous	Cane.*	2,525,649	2,630,000
Total	Both.	6,196,331	6,360,000

**Louisiana Planter*, Nov. 14, 1891. †*The Sugar Beet*, for November.

Sugar Beets in the United States.

To-day beet sugar factories are in successful operation in California, Nebraska and Utah, and it is safe to say that in a short time it will be sufficiently demonstrated that other localities can profitably engage in the industry. Already work is under way for the construction of factories in other places.

At first many mistakes were made in the industry, and failure was the result of poor business management and unsuitable locations.

Although there is quite a wide belt extending across the United States—a belt extending 100 miles on each side of the isotherm of 70° Fah., within which limit are found the most favorable conditions for beet culture,* so far as temperature is concerned—yet much of this region is, for various reasons, unsuitable for cultivation which renders the actual area very limited.

We can hardly understand why the foreign countries have been allowed to outstrip us to so great an extent, we continuing to import and consume, while there are portions of the United States equally, if not better, adapted to sugar production than France, Germany, or Austria, and while the market is sure yet the United States does not produce one-tenth of the sugar she uses. It is hoped that the experiments in progress in Oregon may verify the belief that the industry can be conducted profitably here.

In order to obtain more definite data concerning the subject, the experiments begun in 1888 were extended, information being sought concerning the following points:—Kind of soil; previous crop; time of planting; first appearance of plants; number of times hoed and cultivated; troublesome insects; diseases; fertilizer previously used; weight of beets on plat; weight of beets calculated for one acre. To secure this data the following letter was sent out from the Station by Prof. P. H. Irish, then in charge of this department:

CORVALLIS, OREGON, February 14, 1891.

Dear Sir:—I write to ask whether you are enough interested in the sugar-beet problem to be willing to raise a measured plot of the beets under the direction of the Oregon Experiment Station, to weigh out the beets at the end of the season, and furnish samples of the same to us for analysis.

The plot would be one by two rods. The seed would be furnished by the Station, and full directions given for cultivation. The results obtained last year were encouraging. Hence it is the intention to obtain fuller statistics this year, not only as to the sugar content of the roots, but also as to yield per acre, i. e., to obtain such statistics as are necessary before capital can be interested in the manufacture of beet sugar in this State. If you are willing to aid us to the extent of growing one-eightieth of an acre of beets, following the directions which will be given, and measuring or weighing carefully the beets raised on the plot, please let me hear from you at your earliest convenience, that I may send directions as to preparation of land. I am yours, respectfully,

P. H. IRISH, Chemist Or. Agr. Expt. Station.

In addition to the above letter, which was sent out to those who had co-operated with the Station the previous year and some others, a notice was inserted in the *Oregonian* to the effect that the Station would distribute seed to a limited number of farmers on condition that said farmers signify their willingness to comply with directions as set forth in the above letter. As a result of this letter and notice about forty farmers were supplied with a small amount of seed.

Because of adverse circumstances from one cause and another quite a

*Bulletin No. 30, U. S. Department of Agriculture.

number failed to continue the experiment to the end. In a large number of cases the report blank was only partially filled out, and some of the more important data was omitted, as the yield, etc., yet data enough has been collected to confirm the belief that Oregon can raise beets rich enough in sugar contents and with at least a fair yield.

SEED.

In addition to the seed sent out by the Station, the State Board of Commerce distributed some seed throughout the State, and a number of beets from parties who received seed from that source were sent to the Station for analysis.

The seed used for the experiment was obtained from the Department of Agriculture at Washington, and of E. H. Dyer, Alvarado, Cal., all of it being imported seed and the best that could be obtained. From the former place two varieties were obtained, the Klein Wanzlebener and the Vilmorin Improved; from the latter the Dippe Klein Wanzlebener. In addition to these, a small quantity of Lane's Imperial sugar beet seed from Thorburn, of New York, was planted at the College. The varieties sent out by the State Board of Commerce were the same as those mentioned above.

CULTIVATION.

The farmers of the State being practically unacquainted with the methods of sugar beet growing, as well as to have a more uniform method of cultivation, the following directions were sent out with each package of seed. These directions were taken from the best German authorities combined with what experience had shown in California, but whether or not they are in all respects suitable for our State remains to be proven.

Method of Growing Sugar Beets to be Followed by those Taking Part in the Co-operative Experiments with Sugar Beets in Oregon.

Soil.—This should, where possible, be a light loam, preferably containing some lime. The land should be well drained. The beet gets the greater part of its food from the ground at a depth of 8 to 12 inches. Hence freedom from excess of water is necessary.

Preparation of Land.—The land selected should have been plowed the fall before planting of seed. As soon as it can be properly worked in the spring the land should be plowed again, this time to a depth of 12 inches. Allow to lie until about one week before the time for seeding. Then plow once more to a depth of 4 to 5 inches, and work the soil up into a fine and *light* condition (i. e., do not pack it down with a drag). After allowing land to lie 5 to 7 days plant the seed. The object of allowing the land to lie is that sufficient moisture may be drawn from below for the germination of the plant, and that the land may be warmed by the sun, after pulverization. No manure should be applied unless in the shape of well-rotted compost put on in the fall. The land on which the beets are to be grown should be measured approximately, and enough ground planted so that it will be possible to take the eightieth of an acre from the plot without including any *outside* rows. In ordinary soil the rows should be eighteen inches apart. In very rich less; and in poor soil more than that distance apart: The conditions should be such that the beets can not attain a greater weight than two pounds each. The seed should be planted one-half to

three-quarters of an inch deep, and about 20 pounds of seed used to the acre. Plant, where possible, in April.

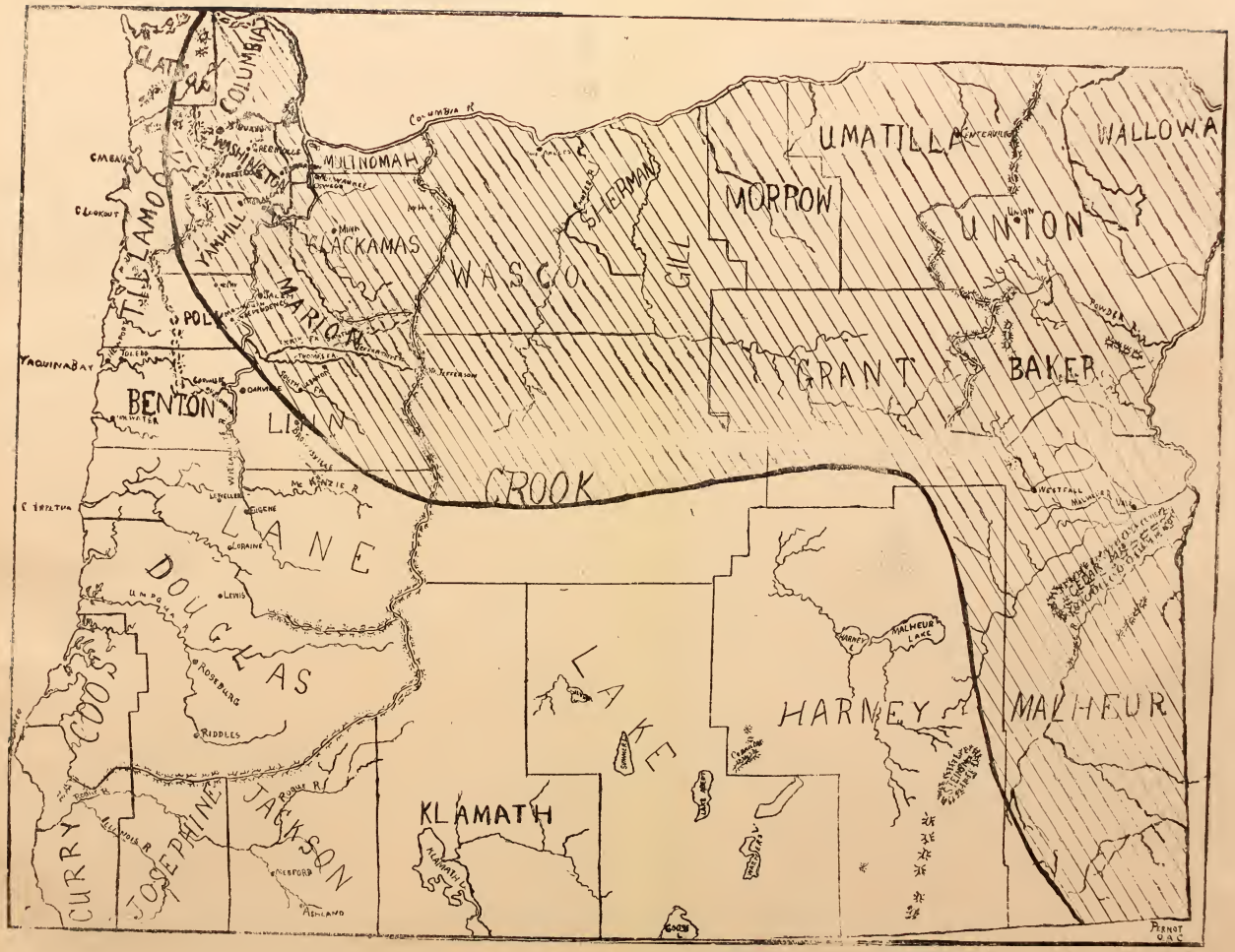
CULTIVATION.—This must be thorough, and should begin as soon as the plants show in the row. When the beets have put out four leaves thin them out so as to leave the plants standing about 4 to 6 inches (not farther) apart in the row. The weeds should be kept down and the ground well stirred. It should be remembered that a beet which grows up out of the ground is worthless for sugar, also that the beets must not attain to a weight greater than two pounds apiece, and must be smooth and tapering in shape.

Climate and Soil.

In the matter of climate and soil our State compares favorably with foreign centres of beet culture. The sugar beet does not differ from other plants in requiring certain conditions of climate to yield favorable results. In foreign countries where beets are being raised this subject has been pretty satisfactorily settled, but in some parts of the United States the conditions under which beets are grown successfully, so far as rainfall is concerned, at least, differ very materially.

The subject of temperature with reference to the sugar beet has been very carefully studied by Dr. Mc Murtrie, who has constructed his mean isotherm for beet culture at 70°F. for June, July and August. Taking this as a basis Mr. H. W. Wiley in his report on beet culture gives a map of United States showing 100 miles on each side of this isotherm, within which area favorable results may be looked for. The inserted map shows this area as given for Oregon, and on the same map are given the localities in which beets having over 12 per cent. sugar have been raised. A large portion of this area given as favorable to beet culture lies in the eastern and southeastern part of the State, and because of the peculiar climatic conditions there existing, it will be essential to study the subject of irrigation before definite results can be had for that portion of the State. It is not by any means certain that good sugar beets cannot be raised in other portions of the State than the area given on the map, and concerning this, Bulletin number 27, of the Department of Agriculture, says: "There are many localities lying outside the indicated belt both north and south, where doubtless the sugar beet will be found to thrive. The map therefore, must be taken to indicate only in a general way those localities at or near which we should expect success to attend the growth of sugar beets in the most favorable conditions other than temperature alone."

This has already proven true in some instances, and for this coast it is notably true in California. It is more than likely that it will also prove to be the case that good sugar beets can be raised outside the limits given for Oregon; at least the evidence in hand goes to show this. Indeed, the best showing has been made by Southern Oregon, where analyses of 10 lots show an average of 13.95 percent. sugar in the juice, while in the Willamette valley the average of 69 separate analyses gave an average of 13.38 percent. sugar and an average beet of a little over 1½ lbs. weight.


CLATSOP
COLUMBIA
WASHINGTON
MULTNOMAH
CLACKAMAS
TILLAMOOK
YAMHILL
MARION
POLK
BENTON
LINN
LINCOLN
WASCO
SHERMAN
GILLIAM
MORROW
UMATILLA
WALLOWA
UNION
GRANT
BAKER
CROOK
JEFFERSON
DESCHUTES
LANE
DOUGLAS
COOS
CURRY
JOSEPHINE
JACKSON
KLAMATH
LAKE
HARNEY
MALHEUR
Columbia R.
McKenzie R.
Rogue R.
Umpqua R.
Klamath R.
Malheur Lake
Harney Lake
Crater Lake
Newport
Eugene
Lorraine
Lewis
Roseburg
Riddles
Grants Pass
Medford
Ashland
Klamath Falls
Lakeview
Burns
Prineville
Madras
Condon
Fossil
Canyon City
John Day
Baker
La Grande
Enterprise
Pendleton
Hermiston
Arlington
The Dalles
Hood River
Astoria
Tillamook
Toledo
Yaquina Bay
Lincoln
Albany
Corvallis
Dallas
Salem
Oregon City
Gresham
Portland
Hillsboro
Forest Grove
Cannon Beach
Lakeside
Bandon
Port Orford
Gold Beach
Brookings
Agness
Reedsport
Florence
Waldport
Newport
Toledo
Yaquina Bay
Cape Blanco
Cape Arago
Coos Bay
North Bend
Myrtle Point
Powers
Coquille
Bandon
Gold Beach
Brookings
Agness
Illinois R.
Rogue R.
Umpqua R.
Siuslaw R.
Alsea R.
Yaquina R.
Nestucca R.
Wilson R.
Trask R.
Tillamook Bay
Nehalem R.
Clatsop Plains
Columbia R.
Willamette R.
Santiam R.
Clackamas R.
Sandy R.
Hood R.
Deschutes R.
John Day R.
Umatilla R.
Grande Ronde R.
Wallowa R.
Snake R.
Owyhee R.
Malheur R.
Silvies R.
Donner und Blitzen R.
Chewaucan R.
Warner Lakes
Abert Lake
Summer Lake
Goose Lake
Upper Klamath Lake
Lower Klamath Lake
Tule Lake
Clear Lake
Gerber Reservoir
Malheur Lake
Harney Lake
Crater Lake
Diamond Lake
Odell Lake
Waldo Lake
Timothy Lake
Clear Lake
Detroit Reservoir
Foster Reservoir
Green Peter Reservoir
Lookout Point Reservoir
Fall Creek Reservoir
Dexter Reservoir
Cottage Grove Reservoir
Siuslaw National Forest
Siskiyou National Forest
Rogue River National Forest
Umpqua National Forest
Willamette National Forest
Deschutes National Forest
Ochoco National Forest
Malheur National Forest
Wallowa National Forest
Whitman National Forest
Umatilla National Forest
Mount Hood National Forest
Columbia National Forest
Tillamook Burn
Bull of the Woods Wilderness
Three Sisters Wilderness
Mount Jefferson Wilderness
Mount Washington Wilderness
Diamond Peak Wilderness
Crater Lake National Park
Oregon Caves National Monument
John Day Fossil Beds National Monument
Newberry National Volcanic Monument
Lava Beds National Monument
Modoc National Forest
Fremont National Forest
Winema National Forest
Klamath Indian Reservation
Warm Springs Indian Reservation
Umatilla Indian Reservation
Burns Paiute Indian Reservation
Siletz Indian Reservation
Grand Ronde Indian Reservation
Coos Bay Indian Reservation
Coquille Indian Reservation
Cow Creek Indian Reservation
Siuslaw Indian Reservation
Alsea Indian Reservation
Yaquina Indian Reservation
Nestucca Indian Reservation
Tillamook Indian Reservation
Clatsop Indian Reservation
Columbia Indian Reservation
Willamette Indian Reservation
Santiam Indian Reservation
Clackamas Indian Reservation
Sandy Indian Reservation
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Lookout Point Reservoir Indian Reservation
Fall Creek Reservoir Indian Reservation
Dexter Reservoir Indian Reservation
Cottage Grove Reservoir Indian Reservation

In general the temperature of Oregon seems well suited to the culture of the beet as will be seen by a study of the temperature charts given on the tenth page. No chart is given for Southern Oregon as on comparing temperature it was found to correspond so nearly to the curve for the Willamette valley that it seemed unnecessary to take up the space.

The season for the growth of beets may be divided into three periods—that of germinating; that of plant formation; and that of sugar-storing. Below will be found a comparative table showing the temperature averages for Germany and certain parts of Oregon during these periods.

Temperature Chart for Periods of Growth.

Periods of Growth.	Av. Temp. Foreign.	Av. Temp. East. Oreg'n	Av. Temp. Willam. Val.	Av. Temp. Southern Or.
First	49.1	56.0	52.5	53.1
Second	63.3	65.0	64.4	64.5
Third	56.3	64.4	63.3	54.8

When we compare these data it would seem that Oregon is at least fairly situated so far as the temperature is concerned.

It is in the rainfall in the State that we find the greatest seeming deviation from the portions of the world which are taken as typical beet-producing regions. This seeming difference should not be considered as a too serious drawback, nor would it appear so to those acquainted with all the conditions here. The average amount of rainfall does not differ much from that of the beet-growing regions of other countries, yet it is not as evenly distributed. It must be borne in mind, however, that the soils of Oregon are much different with respect to their retentiveness of moisture, and that for all our crops the necessary moisture nearly all falls during the "wet season," and for this reason we do not usually consider the *monthly* rainfall as bearing so close relation to the crops as is considered in most other states, but rather have come to consider the *seasonal* precipitation as the more important factor. Consequently tables for seasonal precipitation are given rather than for the monthly, and the places chosen are such as *fairly* represent the different portions of the State.

Seasonal Precipitation Chart.†

LOCALITY.	SPRING. Mar–May	SUMMER. Jun–Aug	AUTUMN. Sep–Nov	WINTER. Dec–Feb	Years Observd
LaGrande, Eastern Oregon	4.10	2.26	2.38	15.81	2
The Dalles, Central Oregon	2.93	.88	3.98	8.50	13
Albany, Willamette Valley	10.07	2.43	9.75	22.76	8
Roseburg, Southern Oregon	8.22	1.79	8.00	17.60	10
Newport, Coast Region	11.60	8.16*	10.72	34.50	2
Ashland, Southern Oregon	4.79	1.61	4.90	11.63	4
Lakeview, Lake Region	4.32	3.09	3.18	6.79	3

*For two months only. †Compiled from State Weather Service data.

That the result of this season's work may be better interpreted, tables are given below for precipitation and temperature in 1891, and the departure from the normal also indicated for various parts of the State, the same general regions being taken as are indicated above. The tables are also compiled from the reports of the State Weather Service.

Precipitation Chart for 1891.

LOCALITY.	March		April		May		June		July		Aug.		Sept.		Oct.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
Coast	5.83	−2.01	8.20	†3.67	3.37	† .13	4.33	†2.04	.66	− .52	1.21	† .40	4.18	†1.82	6.46	†0.69
Willam'te Valley	2.39	−2.54	3.46	† .71	1.99	− .26	3.08	†1.30	.30	− .41	.86	† .49	2.39	† .84	5.00	†1.57
South'rn Oregon	2.81	− .03	1.39	− .22	3.22	†1.51	1.92	†1.08	.74	† .49	.33	† .09	1.04	† .29	1.70	−0.17
Eastern Oregon	1.99	− .20	.50	− .41	1.52	− .47	2.68	†1.13	1.45	†1.05	.32	† .07	.61	† .16	0.61	−0.54

Temperature Chart for 1891.

LOCALITY.	March		April		May		June		July		Aug.		Sept.		Oct.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
Coast	44.6	−1.1	50 2	†1.6	55.	†1.1	57.8	− .7	61.0	†1.4	64.5	†4.8	58.3	† .5	55.7	†2.7
Willamette Valley	42.9	−3.0	50.4	− .3	57.7	†1.2	58.3	−3.2	66.3	† .6	68.0	†2.8	58.7	† .6	55.2	†1.3
Southern Oregon	46 2	−1.2	51 7	+ .9	57.9	−1.1	59 2	−5.0	68.3	- .6	71.0	†3.8	60.9	†1.4	55.2	†2.9
Eastern Oregon	35.6	−5.8	49.7	− .6	58.3	−1.5	58.2	−2.0	69.2	† .3	69.5	†1.2	59.0	† .2	51.5	†3.2

In the tables given above the average temperature and precipitation are given by months in the column marked "A;" in the column marked "D" is noted the departure, (plus or minus) from the normal of the respective localities.

It will be noticed that in general the spring rains lasted until quite late thereby causing delay in the time of planting, nearly all of which was done in May, whereas under ordinary circumstances the seed could doubtless be in the ground by the middle of April at the latest.

Concerning the soil very little need be said as the beets seem to have so little preference for soils, yet a sandy loam with a subsoil is universally recommended as offering the most favorable conditions of growth. A stiff clay tends to produce a badly shaped beet, while a rich alluvial deposit produces a large beet containing but little sugar. As to the chemical composition of the soil it need only be said that it must contain all the essential elements of plant food as for other plants. "Vilmorin considers that any good soil that will grow wheat and has an arable stratum of 12 to 15 inches, will be well suited to this culture."* In a letter to the writer Mr. Chas. Greissen, of McMinnville, who has recently returned from a visit to the sugar-producing regions of Germany, says a good wheat soil is a good beet soil according to his observations while there. So far as the chemical constituents of the soil are concerned, phosphoric acid seems to bear the closest relation to the amount of sugar, for if this be wanting sugar will not be provided, while a lack of lime would be replaced by potash, soda, or magnesia.†

In general, outside of the stiff clays and adobe soils the soils of the State

*Bulletin No 27, Department of Agriculture. †Champion and Pellet.

may be said to be well suited to the culture of the beet, in answering well to the above conditions, and so far as tested by the plant itself, but so far as observations have been made it would be unwise to draw a broad conclusion as to the soil of the State best adapted to the culture, yet in general the conditions above given have given the best results. Beets have been grown, however, on soil strongly alkaline.

Results of Analyses for 1892.

Terms and Methods.

Other things being equal, medium-sized beets are much more likely to give the true per cent. of sugar for the crop than either small or large samples. Bearing this in mind, instructions were sent to each grower to send only average beets, and the results are based upon the belief that these directions were followed in the main, although there were evidently a few exceptions to this.

Sugar in Beet.—This was determined as usual by the polarization of the alcoholic extract of a known quantity of the grated beet root, the actual amount for work being 26.048 grams.

Sugar in Juice.—This was also determined by polarization, the expressed juice being used instead of the alcoholic extract.

Total Solids.—By this term is meant the entire amount of solid matter in the juice. This was determined by means of a Westphal balance and reference tables.

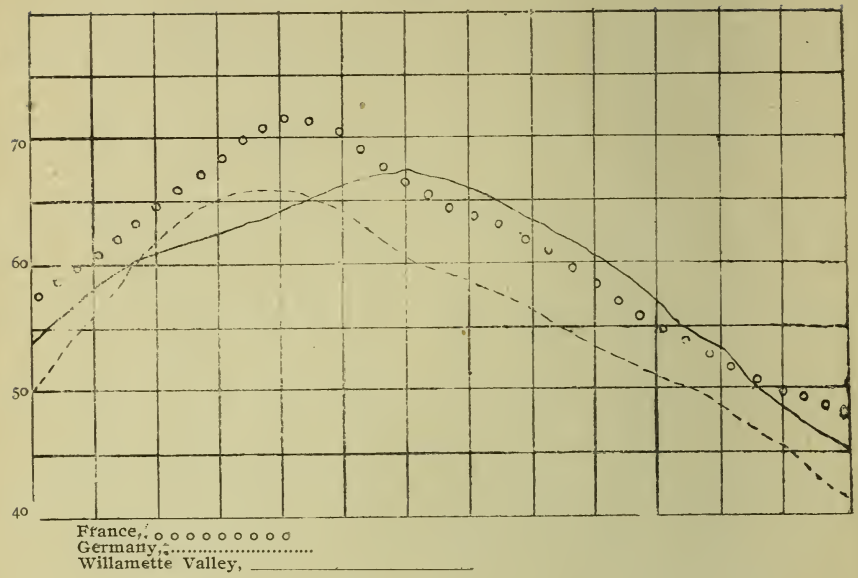
Glucose.—By glucose is meant the non-crystallizable sugar, which was determined by the usual methods.

Purity.—By this is meant the ratio of the sugar to the total solids in the juice

Weight.—This is given in grams mainly from the fact that it seemed more convenient to weigh with this unit, and a lack of time has prevented the conversion of the weights into pounds. For the benefit of those not familiar with this system of weights it may be well to state that one gram corresponds approximately to .03528 ounces.

Some disappointment is felt that the farmers to whom seed was sent did not in all cases take the pains to note carefully the particulars of cultivation and report the same. In many instances where a report accompanied the beets it was incomplete. There were as many as twenty farmers who sent neither beets nor reports although in most of these instances seed had been sent them at their own request.

Comparative Temperature Chart.



Comparative Temperature Chart.

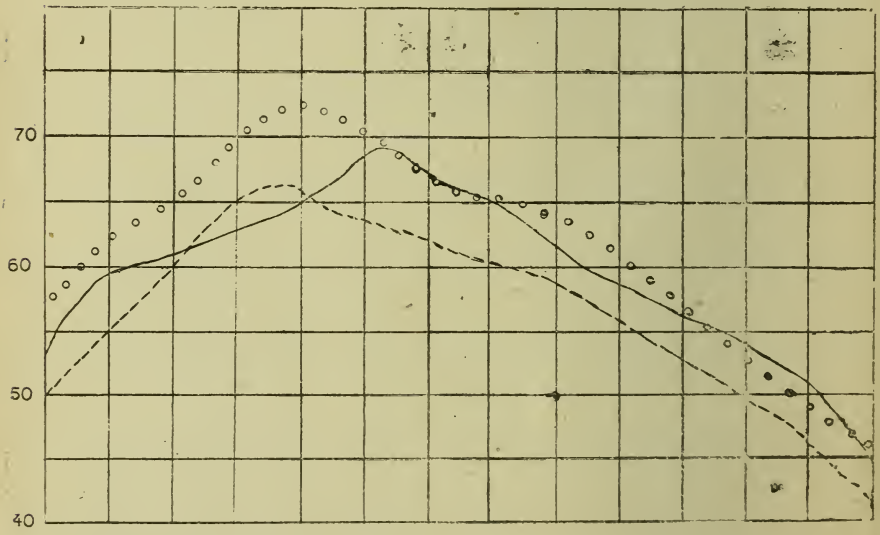


TABLE OF ANALYSES FOR 1891-92.

Laboratory Number	GROWER.	LOCALITY. Post Office and County.	Weight in Grams.	SUGAR. Sucrose in Beet.	Sucrose in Juice.	Glucose	Solids not sugar.	Brix	Purity	KIND
B[illegible]	[illegible]	Ashland, Jackson	241	13.1	13.60	.06	5.24	19.3	77.[illegible]	Klein Wanzlebener
B[illegible]	A. W. L[illegible]	Monmouth, Polk	624	13.3	11.72	.05	.093	18.8	78.[illegible]	" "
B[illegible]	D. S. K. Fouck[illegible]	Roseburg, Douglas	1700	9.32	9.81	.08	4.82	14.4	68.[illegible]	" "
B[illegible]	[illegible]	" "	1130	9.17	10.07	.10	4.[illegible]	14.0	71.[illegible]	Vilmorin Improved
B[illegible]	J. Work[illegible]	Woodburn, Marion	920	14.4	15.07	.62	4.03	20.4	78.[illegible]	Klein Wanzlebener
B[illegible]	H. C. Perkins[illegible]	Llewellyn, Lane	739	10.07	17.[illegible]	.01	1.[illegible]	21.3	80.[illegible]	" "
B[illegible]	[illegible]	" "	600	12.74	14.66	.01	5.[illegible]	20.5	69.[illegible]	" "
B[illegible]	L. F. Wilson[illegible]	Corvallis, Benton	580	10.04	12.16	.04	5.[illegible]	16.8	61.[illegible]	Unknown
B[illegible]	C. D. Thompson[illegible]	" "	375	11.97	13.[illegible]	.11	5.[illegible]	19.4	70.[illegible]	Vilmorin
B[illegible]	H. C. Perkins[illegible]	Llewellyn, Lane	1200	16.10	17.70	.12	4.[illegible]	2.[illegible]	80.[illegible]	Klein Wanzlebener
B[illegible]	C. D. Thompson[illegible]	Corvallis, Benton	735	11.42	12.03	.07	5.[illegible]	18.2	70.[illegible]	Lane's Imperial
B[illegible]	[illegible]	" "	750	11.[illegible]	13.[illegible]	....	....	14.9	75.[illegible]	" "
B[illegible]	[illegible]	" "	330	12.74	14.03	.07	.[illegible]	17.3	81.[illegible]	Klein Wanzlebener
B[illegible]	[illegible]	" "	210	12.[illegible]	14.[illegible]	.09	1.[illegible]	16.8	7[illegible]	" "
B[illegible]	[illegible]	" "	208	14.02	16.[illegible]	.11	2.[illegible]	19.[illegible]	8[illegible]	Dippe Kl.Wanzlebener
B[illegible]	[illegible]	" "	141	12.[illegible]	14.[illegible]	.[illegible]	5.[illegible]	17.[illegible]	7[illegible]	" "
B[illegible]	J. S. Powell[illegible]	Philomath, Benton	384	1.[illegible]	1.[illegible]	....	....	16.0	7[illegible]	Vilmorin Improved
B[illegible]	[illegible]	" "	388	10.70	11.76	.11	5.13	16.9	7[illegible]	" "
B[illegible]	[illegible]	" "	405	11.[illegible]	11.07	.09	4.[illegible]	17.[illegible]	70.[illegible]	" "
B[illegible]	[illegible]	" "	504	11.[illegible]	13.07	.10	5.03	18.2	65.[illegible]	" "
B[illegible]	C. J. Bishop[illegible]	Tidewater, Benton	307	13.[illegible]	13.[illegible]	.10	5.[illegible]	19.6	7[illegible]	" "
B[illegible]	C. D. Thompson[illegible]	Corvallis, Benton	1[illegible]	11.[illegible]	12.[illegible]	.10	.[illegible]	18.[illegible]	8[illegible]	Dippe KlWanzlebener
B[illegible]	[illegible]	" "	2[illegible]	11.[illegible]	12.[illegible]	.13	2.[illegible]	15.[illegible]	78.[illegible]	Klein Wanzlebener
B[illegible]	[illegible]	" "	2[illegible]	6.[illegible]	[illegible]	.10	3.[illegible]	9.[illegible]	7[illegible]	Lane's Imperial
B[illegible]	[illegible]	" "	2[illegible]	11.[illegible]	12.[illegible]	.09	2.[illegible]	15.[illegible]	81.[illegible]	Vilmorin Improved
B[illegible]	[illegible]	" "	2[illegible]	1.[illegible]	12.[illegible]	.14	3.[illegible]	16.[illegible]	7[illegible]	Klein Wanzlebener
B[illegible]	[illegible]	" "	1[illegible]	1.[illegible]	12.[illegible]	.11	1.[illegible]	13.[illegible]	71.[illegible]	" "
B[illegible]	L. F. Wilson[illegible]	Yoncalla, Douglas	7[illegible]	1[illegible]	14.[illegible]	.21	5.[illegible]	19.[illegible]	79.[illegible]	" "
B[illegible]	[illegible]	" "	4[illegible]	13.[illegible]	13.[illegible]	....	....	17.[illegible]	70.[illegible]	Vilmorin Improved
B[illegible]	A. R. Shipley[illegible]	Oswego, Clackamas	4[illegible]	12.[illegible]	14.[illegible]	....	....	18.[illegible]	7[illegible]	Dippe KlWanzlebener
B[illegible]	[illegible]	" "	[illegible]	10.[illegible]	11.[illegible]	.02	3.[illegible]	13.[illegible]	7[illegible]	" "
B[illegible]	[illegible]	" "	945	11.84	12.71	.07	4.62	17.4	73.[illegible]	" "
B[illegible]	John Rickard[illegible]	Corvallis, Benton	1100	8.8[illegible]	9.[illegible]	.11	5.[illegible]	15.[illegible]	6[illegible]	Klein Wanzlebener
B[illegible]	[illegible]	" "	700	8.[illegible]	9.[illegible]	.03	4.71	11.5	7[illegible]	Vilmorin
B[illegible]	[illegible]	" "	650	7.[illegible]	8.[illegible]	.04	4.[illegible]	12.6	61.[illegible]	"
B[illegible]	L. N. Sanders[illegible]	Union, Union	550	10.[illegible]	18.07	....	....	22.[illegible]	80.[illegible]	"
B[illegible]	[illegible]	" "	475	14.36	15.[illegible]	.05	3.70	19.3	80.[illegible]	"
B[illegible]	C. L. Gowell[illegible]	Toledo, Benton	295	16.[illegible]	17.[illegible]	.11	3.00	21.3	80.[illegible]	Klein Wanzlebener
B[illegible]	[illegible] Cooper[illegible]	Roseburg, Douglas	1150	11.45	13.42	.20	3.70	16.3	76.19	Vilmorin Improved
B[illegible]	B. F. Collins[illegible]	Fir, Washington	375	9.37	9.95	.04	2.61	12.6	78.96	"
B[illegible]	R. R. Laughlin[illegible]	North Yamhill, Yamhill	975	9.71	10.73	.13	3.14	14.0	76.64	Klein Wanzlebener (?)
B[illegible]	B. F. Collins[illegible]	Fir, Washington	1145	11.38	11.[illegible]	.11	3.67	15.[illegible]	7[illegible]	"
B[illegible]	G. W. Mitchell[illegible]	Newberg, Washington	1115	10.32	11.65	.02	3.44	16.1	72.29	" " (?)
B[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Vilmorin
B[illegible]	J. D. [illegible]	Boxton, Washington	[illegible]	13.[illegible]	[illegible]	.[illegible]	.[illegible]	19.[illegible]	7[illegible]	Klein Wanzlebener
B[illegible]	W. A. Smith[illegible]	Roseburg, Douglas	[illegible]	9.[illegible]	9.[illegible]	....	....	12.3	8[illegible]	Unknown
B[illegible]	A. Marks[illegible]	[illegible]	1250	10.[illegible]	10.[illegible]	.07	4.[illegible]	15.0	72.[illegible]	"
B[illegible]	John Wickets[illegible]	Lebanon, Linn	785	11.[illegible]	12.[illegible]	.18	2.52	15.7	8[illegible]	Vilmorin Improved
B[illegible]	John Henry[illegible]	Beaverton, Washington	490	13.[illegible]	14.[illegible]	....	....	19.2	8[illegible]	Redtop
B[illegible]	[illegible]	" "	370	14.[illegible]	15.[illegible]	.20	1.[illegible]	18.2	71.[illegible]	Klein Wanzlebener (?)
B[illegible]	C. D. Thompson[illegible]	Corvallis, Benton	475	12.[illegible]	13.[illegible]	.13	3.31	16.8	7[illegible]	Vilmorin
B[illegible]	[illegible]	" "	509	11.91	12.51	.21	2.98	15.7	79.[illegible]	Klein Wanzlebener
B[illegible]	[illegible]	" "	28	11.52	12.05	.06	4.79	16.9	71.[illegible]	Dippe KlWanzlebener
B[illegible]	[illegible]	" "	170	11.10	12.12	.03	3.85	16.0	75.[illegible]	" "
B[illegible]	[illegible]	" "	155	11.68	12.82	.08	3.80	16.7	76.[illegible]	Lane's Imperial
B[illegible]	[illegible]	" "	225	11.18	12.42	.11	3.37	15.9	7[illegible]	Vilmorin
B[illegible]	Samuel Howard[illegible]	Eugene, Lane	[illegible]	11.97	13.00	.09	3.91	17.0	76.47	Unknown
B[illegible]	[illegible]	" "	1080	9.81	11.[illegible]	....	....	15.[illegible]	7[illegible]	"
B[illegible]	R. Scott[illegible]	Milwaukie, Clackamas	[illegible]	12.91	13.[illegible]	.08	2.99	16.8	82.26	Klein Wanzlebener
B[illegible]	[illegible]	[illegible]	[illegible]	11.66	12.[illegible]	.04	4.18	16.4	7[illegible]	"
B[illegible]	T. Pavey[illegible]	Yaquina, Benton	850	14.43	16.23	.10	2.57	18.9	85.82	Unknown
B[illegible]	[illegible] Templeman[illegible]	Eugene, Lane	[illegible]	13.76	14.15	.05	3.10	17.3	81.79	Klein Wanzlebener
B[illegible]	[illegible]	" "	1880	13.58	14.41	.06	3.23	18.0	80.55	" "
B[illegible]	[illegible]	" "	550	13.74	15.18	.08	1.74	17.0	89.29	" "
B[illegible]	M. H. Harlow[illegible]	" "	1700	12.38	12.88	.06	3.16	16.1	80.00	" "
B[illegible]	[illegible]	" "	930	14.20	15.36	.04	2.80	18.2	84.38	" "
B[illegible]	[illegible]	" "	510	15.74	17.61	.04	1.95	19.6	89.84	" "
B[illegible]	[illegible]	" "	575	13.09	14.82	.03	2.75	17.6	84.20	" "
B[illegible]	W. N. Crow[illegible]	Lorane, Lane	682	10.22	11.30	.06	4.65	16.0	70.62	Dippe KlWanzlebener
B[illegible]	J. H. Crow[illegible]	" "	215	14.23	15.69	.05	2.66	18.4	90.70	" "
B[illegible]	C. J. Bishop[illegible]	Tidewater, Benton	875	12.24	13.42	.08	3.30	16.8	79.88	Klein Wanzlebener
B[illegible]	W. R. Wise[illegible]	New Bridge, Union	1150	12.67	13.95	.09	3.96	18.0	77.50	" "
B[illegible]	G. H. Rinehrook[illegible]	Toledo, Benton	450	12.16	13.68	.08	4.64	18.4	74.34	Dippe KlWanzlebener
B[illegible]	[illegible]	" "	460	11.92	13.42	....	.....	17.3	77.57	" "
B[illegible]	C. J. Bishop[illegible]	Tidewater, Benton	927	.....	14.06	....	.....	18.6	75.61	Vilmorin
B[illegible]	John P. Cegg[illegible]	Stafford, Clackamas	720	15.07	16.05	.07	5.28	22.4	71.65	Klein Wanzlebener
B[illegible]	[illegible]	" "	875	12.14	13.42	.11	4.67	18.2	73.73	" "
B[illegible]	C. J. Bishop[illegible]	Tidewater, Benton	412	14.85	15.57	.07	2.26	18.0	86.50	Bulteau Desprez
B[illegible]	[illegible]	" "	405	13.12	14.17	.18	2.25	16.6	84.75	" "
B[illegible]	[illegible] Wilkinson[illegible]	Beaver Creek, Benton	1075	11.59	12.55	.18	4.57	17.3	72.54	Unknown
B[illegible]	Albert Brown[illegible]	Philomath, Benton	825	11.23	12.03	.09	4.28	16.4	73.35	" "
B[illegible]	J. H. Rinck[illegible]	Buxton, Washington	395	14.58	15.71	.12	6.17	22.0	71.40	Klein Wanzlebener
B[illegible]	[illegible]	" "	250	16.09	18.80	.24	1.86	20.9	89.94	" "
B[illegible]	Edw. Albright[illegible]	Ashland, Jackson	325	10.39	10.56	.18	3.96	24.7	85.24	" "
B[illegible]	[illegible]	" "	255	20.99	22.24	.14	3.12	25.5	87.21	" "
B[illegible]	G. H. Baber[illegible]	Forest Grove, Washington	830	13.08	14.38	.11	3.51	18.0	79.88	.....
B[illegible]	J. G. Stephenson[illegible]	Eugene, Lane	495	13.25	14.62	.12	4.26	19.0	76.94	Vilmorin Improved
B[illegible]	[illegible]	" "	475	5.88	7.57	.22	5.11	12.9	58.68	" "
B[illegible]	J. B. Riddle[illegible]	Riddle, Douglas	865	10.48	11.34	.11	4.55	16.0	70.87	Dippe KlWanzlebener
B[illegible]	[illegible]	" "	1010	11.03	12.05	.13	4.52	17.7	68.07	" "
B[illegible]	W. E. Smith[illegible]	Vale, Malheur	350	17.69	19.00	.13	2.77	22.6	84.61	Klein Wanzlebener
B[illegible]	O. P. Coshow[illegible]	Brownsville, Linn	450	11.58	12.61	.19	2.86	16.6	81.98	Unknown
B[illegible]	[illegible]	" "	950	10.53	11.33	.17	4.20	15.7	72.16	" "
B[illegible]	[illegible]	" "	750	18.48	19.87	.20	1.53	11.6	85.68	" "
B[illegible]	[illegible]	" "	600	8.98	10.00	.13	2.67	12.8	78.12	" "
B[illegible]	A. N. Ault (?)[illegible]	Forest Grove, Washington	375	15.00	15.24	.14	5.92	21.3	71.54	Vilmorin Improved
*	J. M. Nye[illegible]	Newport, Benton	555	12.63	13.30	....	.....	16.7	78.40	Klein Wanzlebener
*	Thos. Daniels[illegible]	Mink, Clackamas	500	18.88	11.80	....	.....	22.6	87.60	Unknown
*	J. H. Rinck[illegible]	Buxton, Washington	250	12.04	12.67	....	.....	....	88.80	Klein Wanzlebener

*Reported by U. S. Department of Agriculture at Washington.

CULTIVATION NOTES FOR 1891-1892.

In the following table is given the amount of cultivation which was given to each sample analyzed so far as reports could be obtained.

conditions as pe[illegible] given in the case of yield may be considered as approximate and reliable so far as an estimate can be reliable when computed from the results obtained on a small plat of ground.

So far as reports were received they can be seen in the following table:

CULTIVATION NOTES FOR 1891-1892.

In the following table is given the amount of cultivation which was given to each sample analyzed so far as reports could be obtained.

Laboratory Number	GROWER.	LOCALITY. Post Office and County.	Time of Planting.	Soil.	Cultivation.	Previous Crop.	Wt. of Beet in Grams.	Sugar in Juice.
B1.	Edw. Albright	Ashland, Jackson	May 18	Sandy Loam	Cultivated twice.	Corn	244	14.00
B2.	A. W. Lucas	Monmouth, Polk	" 1	Black Loam	Cultivated once; hoed 4 times	Potatoes	623	14.72
B3.	D. S. K. Buick	Roseburg, Douglas	" 2	" "	Hoed once.	"	1700	9.81
B4.	" "	" "	" 2	" "	" " "	"	1140	10.07
B5.	J. Voorhees	Woodburn, Marion	" 9	Prairie Loam	Hoed twice; cultivated six.	"	920	15.69
B6.	H. C. Perkins	Llewellyn, Lane	Apr. 17	Clay Loam	Hoed 3 times; cultivated once	"	739	17.66
B7.	" "	" "	" 17	" "	" " " "	"	600	14.96
B8.	L. F. Wilson	Corvallis, Benton	.....	.....*	Garden cultivation	Garden	389	13.46
B9.	C. D. Thompson	" "	May 16	Clay Loam	Hoed 3 times.	Weeds	375	13.28
B10.	H. C. Perkins	Llewellyn, Lane	Apr. 17	" "	Hoed 3 times; cultivated 6.	Potatoes	1200	17.70
B11.	C. D. Thompson	Corvallis, Benton	May 16	" "	" " "	Weeds	335	12.63
B12.	" "	" "	" 16	" "	" " "	"	250	12.39
B13.	" "	" "	" 16	" "	" " "	"	330	14.63
B14.	" "	" "	" 16	" "	" " "	"	216	14.02
B15.	" "	" "	" 16	" "	" " "	"	268	16.35
B16.	" "	" "	" 16	" "	" " "	"	312	14.50
B17.	J. S. Powell	Philomath, Benton	" 12	Sandy Loam	Hoed and Cultivated.	Beets	384	13.08
B18.	" "	" "	" 12	" "	" " "	"	388	11.36
B19.	" "	" "	" 12	" "	" " "	"	465	11.97
B20.	" "	" "	" 12	" "	" " "	"	594	13.07
B21.	C. J. Bishop	Tidewater, Benton	" 20	" "	Hand cultivated 4 times.	"	397	14.46
B22.	C. D. Thompson	Corvallis, Benton	" 16	Clay Loam	" " 3 "	Weeds	175	12.86
B23.	" "	" "	" 16	" "	" " " "	"	285	12.51
B24.	" "	" "	" 16	" "	" " " "	"	200	9.73
B25.	" "	" "	" 16	" "	" " " "	"	200	13.00
B26.	" "	" "	" 16	" "	" " " "	"	780	12.88
B27.	" "	" "	" 16	" "	" " " "	"	642	12.95
B28.	J. D. Wilson	Yoncalla, Douglas	.....*	.....*	.....	.....*	348	14.75
B29.	" "	" "	.....*	.....*	.....	.....*	496	14.32
297	A. R. Shipley	Oswego, Clackamas	Apr. 11	Silt Land	Garden Cultivation.	Garden	424	14.05
B30.	" "	" "	" 11	" "	" "	.....*	.....	12.00
B31.	" "	" "	" 11	" "	" "	.....*	945	12.71
B32.	C. L. Gowell	Toledo, Benton	May 14	Bottom	Hoed 11 times.	Potatoes	905	15.29
B39.	B. F. Collins	Fir, Washington	" 2	Clay—New	Reasonably good.	.....*	375	9.95
B40.	R. R. Laughlin	North Yamhill, Yamhill	Apr. 23	New Bottom	Hoed 3 times.	None	975	10.73
B41.	B. F. Collins	Fir, Washington	May 2	New Clay	Reasonably good.	.....*	1145	12.17
B42.	G. W. Mitchell	Newberg, Washington	.....*	Clay Loam	" "	.....*	1115	11.64
B43.	J. C. Johnson	Scappoose, Columbia	May 1	.....*	Hoed 3 times.	.....*	495	13.74
B44.	J. H. Rinck	Buxton, Washington	" 8	Sandy Loam	Hoed once.	Oats	225	15.61
B47.	John Withers	Lebanon, Linn	" 11	Light Loam	Cultivated 3 times; hoed twice	Wheat	187	12.93
B48.	John Henry	Beaverton, Washington	" 15	Loam	Hoed twice.	Timothy	480	14 38
B49.	" "	" "	" 15	" "	" "	"	340	13.02
B50.	C. D. Thompson	Corvallis, Benton	" 16	Clay Loam	Hand cultivated 3 times.	Weeds	475	13,36
B51.	" " ..	" "	" 16	" "	" " "	"	509	12.51
B52.	" " ..	" "	" 16	" "	" " "	"	283	12.05
B53.	" " ..	" "	" 16	" "	" " "	"	170	12.12
B54.	" " ..	" "	" 16	" "	" " "	"	155	12.82
B55.	" " ..	" "	" 16	" "	" " "	"	225	12.42
B56.	R. Scott	Milwaukie, Clackamas	Apr. 18	Sandy Loam	Hoed 3 times; cultivated 3.	Potatoes	1213	13.82
B66.	T. Pavey	Yaquina, Benton	May 12	Clay Loam	Cultivated twice.	.....*	850	16.23
B68.	W. N. Crow	Lorane, Lane	Apr. 27	Dark Loam	Cultivated twice; hoed 3.	Melons	682	11.30
B69.	J. H. Crow	"	" 20	Sandy Loam	Fair.	.....*	215	15.69
B70.	C. J. Bishop	Tidewater, Benton	May 20	" "	Hand cultivated 4 times.	Beets	875	13.42
B71.	W. R. Wise	New Bridge, Union	" 20	" "	Hoed 3 times.	Potatoes	1150	13.95
B72.	G. H. Rosebrook	Toledo, Benton	Apr. 21	" "	" "	Beets	450	13.68
B73.	" "	" "	" 21	" "	" " "	"	460	13.42
B77.	C. J. Bishop	Tidewater, Benton	May 20	" "	Cultivated 4 times.	"	412	15.57
B81.	J. H. Rinck	Buxton, Washington	May 8	" "	Hoed once.	Oats	305	15.71
B82.	" "	" "	" 8	" "	" "	"	250	18.80
B83.	Edw. Albright	Ashland, Jackson	" 18	" "	Cultivated twice.	Corn	325	20.56
B84.	" "	" "	" 18	" "	" "	"	256	22.24
B85.	G. H. Baber	Forest Grove, Washington	Apr. 30	.....*	Excellent.	Garden	830	14.38
B86.	J. G. Stephenson	Eugene, Lane	May 1	New Loam	Good.	.....*	495	14.62
B90.	W. E. Smith	Vale, Malheur	" 14	Sandy Loam	Hoed 4 times.	Potatoes	350	19.00

*Not reported.

As will be seen from the table of analyses there has been a very wide range of sugar percentages, viz. from 6.77 percent to 22.44 percent, of sugar in the juice. Of the 95 analyses made at the Station, 8 fall below 10 percent of sugar, 76 show over 12 percent, and 37 show over 14 percent.

The average of 69 analyses of beets raised in Willamette valley give an average weight of a little over 1¼ lbs. for the beet, while an average of 10 analyses of beets from Southern Oregon and 13.38 percent. sugar with a little larger beet than the average for Willamette valley.

The question now arises as to how rich a beet must be in saccharine matter to be valuable for sugar. In general the lowest workable beets must contain 12 percent sugar. At the present time the typical beet for sugar manufacture may be said to be one weighing about 600 grams (a little over one pound), carrying 14 percent sugar with a purity of 80.* When these data are compared with these set forth in the table, it will be seen that the showing is a creditable one.

A great many letters written by the growers to the Station show that the cultivation was not in all cases what could be desired, and the same thing was also indicated by some of the beets received. This seems to be particularly true concerning the preparation of the ground for many beets were of an irregular shape as shown in Plate II. which is made from photographs of beets received at the Station. It will be noticed that these beets are all "scraggly," showing that the ground was not worked to a sufficient depth. The beets shown in this plate are poor, and such beets are not easily disposed of for sugar purposes. It should always be borne in mind that beets which are profitable for the manufacturer are also profitable for the farmer to raise, and it may well be doubted whether these are not the only beets that are profitable to be raised.

In addition to being irregular in shape, which is of itself bad, branching beets are also usually sun-burned, as they have usually been lifted partially out of the ground by their own growth. In some instances beets were received at the Station from which it would be necessary to reject fully one-half the beet as unsuitable for sugar manufacture, because allowed to grow above the ground. One of the worst things to befall a beet crop is growth above ground.

The best beets for sugar purposes are the long tapering roots without branching rootlets, and if the soil has been properly prepared, and the cultivation has been of the proper kind, beets will always take the tapering form shown in Plate III., which illustrates beets grown in the State during the present year.

YIELD AND COST.

From the circular sent out the reader will see that an attempt was made to ascertain pretty reliable estimates *in our own* State on these two points, but the reports received were very meagre, and even those given, in the case of cost, were incomplete and much too low. It is found necessary, then, to look elsewhere for this matter. In order to take as near similar conditions as possible. The few estimates given in the case of yield may be considered as approximate and reliable so far as an estimate can be reliable when computed from the results obtained on a small plat of ground.

So far as reports were received they can be seen in the following table:

Table of Estimated Yield.

GROWER.	Post Office.	County.	Reported Yield in Tns.	Theoretical Yield in Tons.*	Probable Yield of Sugar per Acre.
Edw. Albright...	Ashland	Jackson	12.0	10.18	3584.0
A. W. Lucas.....	Monmouth	Polk	30.0	27.50	8832.0
D. S. K. Buick.....	Roseburg	Douglas	25.0	.....†	2385.8
H. C. Perkins.....	Llewallyn	Lane	18.0	32.50	4386.4
J. Voorhees	Woodburn	Marion	21.5	40.50	6184,2
J. S. Powell..	Philomath	Benton	32.7	15.80	9364.6
W. E. Smith	Vale	Malheur	20,0	15.40	7076.0
J. H. Rinck.....	Buxton	Washington	17.4	9.90	5056.4
John Henry.....	Beaverton	Washington	5.1	21.10	1287.2
R. Scott.....	Milwaukie	Clackamas	44.2	53.40	9025.6
J. H. Crow.....	Lorane	Lane	11.0	9.50	3130.6
C. D. Thompson.....	Corvallis	Benton	5.1	21.10	1287.2
Average.....			20.5	23.34	5133.3

*The so-called theoretical yield assumes there are 40,000 beets to the acre, which in general holds true for beets weighing less than 800 grams.
†Weight of beet over 800 grams. See previous note.

These results, although meagre, show an excellent average, yet the number of places from which reports were received render it unwise to draw any definite conclusion as to an average yield. It may be said with safety, however, that it will not fall below 15 tons to the acre.

As to the cost of sugar beet raising the nearest approach to our own State that can be secured is found in the sister State of California. The results given below are condensed statements of growers in this State, and the figures given are those obtained from actual experience..

*"A. F. Richardson, two miles from factory, eleven acres: Plowing and harrowing, $110; sowing, $6: harrowing and sowing, $3; 4 days' cultivation first time at $2—$8; 23 days' thinning at $1.25—$28.75; 24½ days' thinning and hoeing at $1.25—$30.65; 5 days' hoeing at $1.25—$6.25; 9 days' hoeing at $1.75—$15.75; 7 days' hoeing at $1.75—$12.25; 9½ days' hoeing, second time, at $1.75—$7; fixing plow, $2.50; two knives, $1.50; 4 baskets, $3.50; topping and loading, 170.05 tons at 80 cents—$136.04; hauling at 50 cents, $85; plowing up at 20 cents, $34; total, $508.59; yield, 170.05 tons; value, $821.81; net profit, $413.22; net profit *per acre*, $37.56."

These results were obtained in 1889 when the farmers were practically unacquainted with the most economical methods of cultivation and it is safe to say that with a little more experience in the methods of working most of the items would be rendered somewhat lower. These figures are not theoretical, but are the actual accounts given by growers.

So far as reports were received at the Station all estimates were lower than those given above, the range being from $11.25 to $24.18, some of which included harvesting and some did not. The cost of the beets raised

*Marysville *Appeal*, Cal.



Plate II.



Plate III.

at the College this year, which did not include harvesting, was $42.50 per acre, but all the work was done by hand at the rate of $1.50 per day and by student labor, whereas much work could have been done by team had the College been supplied with all the necessary implements, and this would have reduced the cost by a considerable amount.

While the figures given by the formers are too low, the cost of raising the beets at the College was too high. It is, of course, difficult to ascertain the cost of raising a number of acres from a small plat, but the statement of the California growers can be taken as approximately correct.

Right in this connection comes the price that can be realized for the beets if disposed of to a factory. By the kindness of Mr. E. H. Dyer, we are enable to publish the contract used by the Pacific Coast Sugar Company which is similiar to that used by all others.

THIS AGREEMENT, Between the Pacific Coast Sugar Company, party of the first part, and————party of the second part,

Witnesseth, That for and in consideration of the convenants hereinafter contained, on the part of the said party of the first part, the party of the second part agrees and covenants to and with the said party of the first part, that the said party of the second part shall and will plant, cultivate, harvest and deliver to the said party of the first part, at their Sugar Works, near Alvarado, Alameda county California, (unless some other place is designated in the margin of this contract) during the current planting and harvesting season of 188 Sugar Beets of the seed to be furnished for that purpose by the said party of the first part, to the extent of————acres of land on the Farm occupied by the said party of the second part in said County; the particular tract to be so cultivated being now selected and agreed upon between the parties thereto. The party of the second part is to prepare the soil at the proper time, and without delay to commence the cultivation of said crop of beets, using sowing machines approved by the parties of the first part, and at the proper time thin them out, so that as a general rule they will stand not over four inches apart in the rows. As soon as matured, the said party of the second part is to commence and proceed with the harvesting and gathering of the crop, and to continue the delivery thereof, clean and in good condition, and with the tops closely and squarely cut off at the base of the last or bottom leaves, until the said crop shall be exhausted. The amount to be delivered shall be increased or diminished to meet the requirements of the factory, as they may direct. It being understood and agreed that after the 31st day of October, Beets will be received as fast as they can be delivered.

All Beets delivered under this contract are to be piled in a proper manner under the direction of the parties of the first part, or their agents, or delivered direct in the factory by the party of the second part. And any damage done said Beets after they have been delivered as aforesaid, by the horses, wagons, or from any other cause, shall be charged to the party owning the Beets hauled by said teams, and deducted from the price to be paid for said Beets under this contract. Should the party of the second part neglect or refuse to comply with the above conditions, the parties of the first part have the right, at their option, to cancel this contract.

Very large Beets, or those grown mostly above ground, or defective, and unfit to be manufactured into sugar, will not be received.

The parties of the second part further agree that they will keep their Beets protected from frost and sun until delivered to the factory, and in the event of any earth being left upon said Beets, the party of the first part shall have the right to deduct the weight of such earth from the total weight of said Beets.

It is further agreed that the parties of the second part, who contract to raise a majority of the number of acres of Beets for the parties of the first part, shall have the privilege of selecting two competent and disinterested men, who shall be acceptable to the parties of the first part, to superintend the delivery, weighing and piling of all Beets delivered under this contract, and who shall decide whether or not the said Beets are delivered of the quality and in the condition contemplated by this contract: and if in their judgment they are not, they are to make a proper deduction, or reject them, as they may think proper and just. The salaries of these two men, while thus employed, are to be paid by the parties of the first part. But if the parties of the second part fail or neglect to select the two men above mentioned, then the parties of the first part shall make such selection.

In consideration whereof, the said party of the first part agrees to furnish the necessary Beet seed at cost, which shall not exceed twenty cents per pondd, and which alone be employed in raising said crop; the amount of the cost of said Seed, and any advances made by the parties of the first part on account of Beets raised under this contract with interest on cash advances at the rate of ten per cent. per anum, to be deducted from the price of Beets to be first delivered under this contract, until the party of the first part is reimbursed; and to pay thereafter to the party of the second part four dollars ($4.00) in gold coin, or its equivalent, per ton for all such Beets, to be cultivated and delivered in accordance with the terms of this agreement, in thirty days after the last Beets are delivered.

Witness our hands and seals the ——— ———day of ——— ——— ———188

That the farmers of California are pleased with the results, when working under this contract is shown by the following article taken from the Watsonville "Pajornian." "The beet sugar factory is in the field with its contracts for the campaign of 1892, and several good contracts have been signed, and the company has the promise of other fine tracts of land.....A straight price of $5 per ton is offered, or you can have a polarization contract with a minimum price of $4 per ton..... The beet crop was one of the best payers this year and we hear of nothing but satisfaction on the part of growers, this is an encouraging fact for the coming season, and is bound to assure a big acreage for the coming season."

In a letter to this Station Mr. Dyer says:—"There can be no reason to doubt but Oregon can produce beets as rich in sugar as any part of the world. The result of your tests furnished me go to prove it; if you can raise *one* rich beet, you can certainly produce an unlimited quanity by adopting proper methods of cultivation. Sixteen percent is very good. By proper care in cultivation, all could have shown as good results or better. I have just received a box of beets from Coquille that *averaged* over 17 per-ecnt. Parties in many parts of Oregon are looking into the matter..... I hope it will not result in "all talk". No state in the Union has more favorable conditions for conducting the business successfully."

Mr. John Henry, of Beaverton, a gentleman well versed in root growing writes concerning the work in Oregon as follows:—

* * * * * My opinion is that a problem for the Oregon farmer is how to grow the roots profitably at the price a factory could afford to pay, say four dollars per ton, I believe it can be done in this way. It should be on land that is now devoted to hay, grain or other crops of low money yield per acre, while the land must be fertile enough to yield, the heaviest crop that is consistent with a due percentage of sugar.

The land must be well drained by nature or art to dry it soon enough in the spring to work two or three times with a harrow or a cultivator that the weeds may be destroyed before the seed is sown. Horse labor should be used to the exclusion of hand labor where-ever practicable, of course; the sowing and digging should be done with horse labor and also as much as possible of the cultivating.

Topping the roots by hand is a costly job when they are of small sizes but I think it can be done with sharp hoes before digging at less cost than with knives after digging.

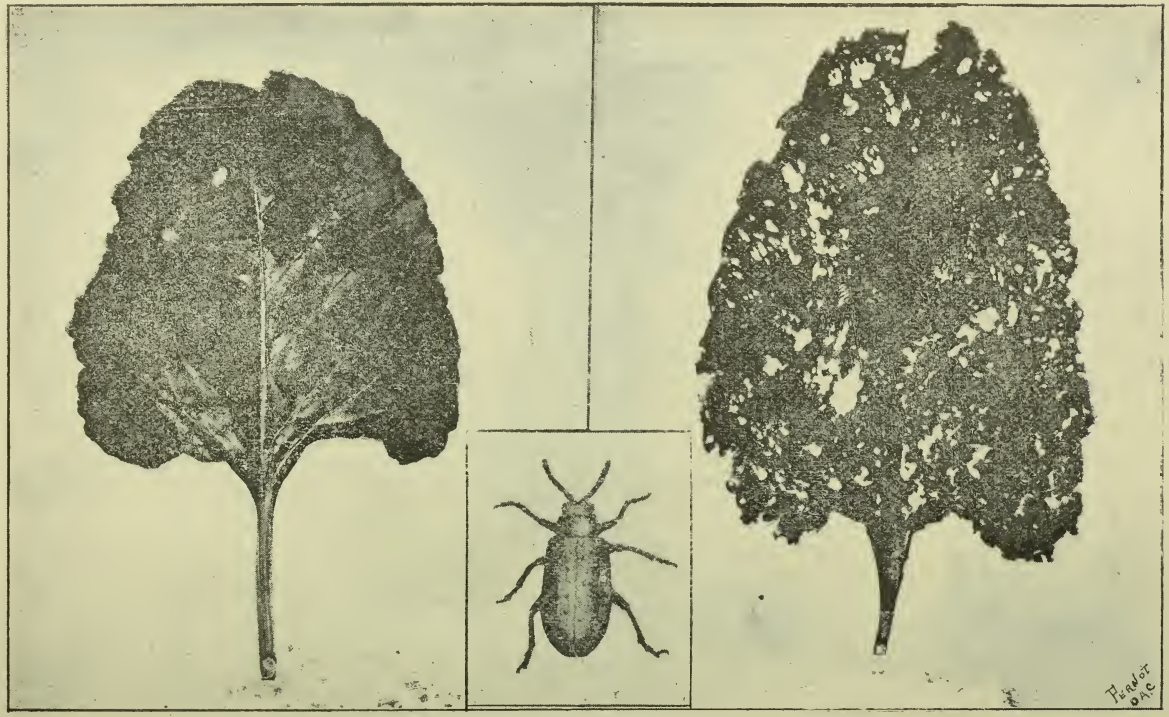
In harvesting the larger crops of carrots the tops are cut off with hoes and then the roots are thrown out with a plow because this is the most economical way of harvesting them, and I see no reoson why the sugar beets cannot be treated likewise. If I were growing sugar beets on a large scale I would try a mowing machine for topping and a horse rake for clearing the ground, then use an adopted one-horse subsoiler for loosening the roots so that they could be lifted out by hand. Of course the beet grower should have every required implement for quick and effective weeding and thinning. Among them should be either a wheel or a push hoe for cleaning both sides of the row at the same time.

When sugar factories are started in Oregon, I suppose it will be in the grain districts of the Willamette valley, and I fear the average grain grower will make a very indifferent root grower at the start, and until he learns for himself he should be informed that profit in sugar beets lie in the sum of small economies; That without good management there can be no success, and that if he "holds his own" with the first crop his experience will make the future ones profitable. But the one thing that should be most strongly impressed on his mind is this; He must weed his ground with hoes before sowing the beets. An example will explain the importance of weeding before seeding. The average cost of keeping an acre of onions clear of weeds for the season is $35 while I have kept an acre of carrots clear for $10 the season for the difference being that the onions are sown early before there is time or weather for destroying weeds with horse labor while the carrots are not sown till late in May.

I hesitated to express an opinion about the cost of weeding and thinning an acre of sugar beets for the reason that so much depends on the weather and circumstances. The result obtained by myself this season on the patch grown for the Station is of little value. On a field of 10 or 20 acres, with the ground properly prepared in advance, I could weed it for at least 20 per cent. less than on the patch referred to. I think, however, that the total cost of an acre of beets from the end of seeding to the beginning of digging can be kept between $18 and $20. I can of course make no estimate of the cost per ton of roots as that will depend on the yield.

* * * * * * * * * *

I firmly believe that the growing of sugar beets can be made profitable in Oregon but to present facts in a misleading light is but to delay success.



Perfect Leaf. *Monoxia guttulata*. Affected Leaf.

Plate IV.

Concerning the ideas in the above letter we make no comment other than to say that Mr. Henry's idea of doing all work possible by team is very correct and machines for such work can be had. It is further expected that such machinery would be used if beets were raised for sugar purposes in the state.

ENEMIES.

It is not proposed to discuss this subject to any great extent in this Bulletin since it belongs to the entomologist's work, consequently for a further discussion of these pests than is given here the reader is referred to the publication of the entomologist of this Station. It will only be proper, then, to call attention in a very brief way to those pests reported by the farmers.

There were but few pests reported as troubling the sugar beet. The most to be feared is perhaps, *Monxia guttulata*, as reported by Prof. F. L. Washburn and described by him in Bulletin No. 14, of this Station.

There was also sent to this Station and referred to Prof. Washburn another insect which was said to be troubling the beets raised in Clackamas county. This pest known as the "flea-beetle"—*Phylotreta decipiens* (Horn) belonging to the family *Halticidae* is about ⅛ inch long, and of a black color. With other members of the same family, it has the femrers of the hind pair of legs strongly developed, and when alarmed jumps with so much alacrity that it is difficult to catch them, hence the popular name of the family.

They are found on radishes, turnips, potato vines etc. It is not likely that they are a serious enemy of the sugar beet. Should they become so, the treatment recommended for *Monoxia guttulata* would apply equally well to them.

The "cut worms" were also reported to have caused considerably damage to the beet in Central Oregon. In fact, they were reported as having in some instances destroyed the entire crop.

Gophers also caused some trouble in Benton county and are said to have shown a decided preference for the sugar beets.

Summary and Conclusions.

The subject under discussion is one of the highest importance to Oregon at this time, and one which deserves the most careful consideration from all interested in the welfare of the State. The investigations have progressed far enough to indicate that we have sections in the State naturally adapted to the culture of the sugar beet, and in general this is out of the area indicated by shading on the map given on page —.

No other one industry would add so much to the welfare of the State as this, and without bringing injury to the present lines of production. Indeed, the experience in Europe teaches that beet culture adds much to the wealth of such portions as are engaged in the industry. Concerning the same thing Mr. E. H. Dyer says that at Alvarado, Cal., where a sugar

factory is located, land will rent, cash in advance, for sufficient to pay interest and taxes on land worth $350 per acre.

If the farmers undertake beet raising the crop should be one of rotation, and could be grown instead of allowing the ground to be idle in summer fallow. It has been found in Europe that it is much more profitable as well as better for the land to raise a crop of beets than to allow the ground to lie fallow. Instead of substituting beets for some other crop as suggested by Mr. Henry, the farmer should not allow it to supplant any, but make it supplemental to the present available crops. No farmer should think of giving up cereals or potatoes for beets; but he can by proper culture devote one-fifth of his land to beet culture and raise as much from the remainder as though none of the land was occupied by beets.

A very large amount of beets must be furnished to keep a factory supplied. The quality must be good and they must be furnished at a price a factory can afford to pay. A successful plant should have at least 50,000 tons of beets containing 12 per cent. sugar, and for such the factory should pay $4 per ton, delivered at the factory, and can pay an additional price for each per cent. over twelve. Beets cannot be raised successively on any soil, and it would require at least 7000 acres of beets for a rotation. This must be near enough to a factory so that the profit would not be eaten up in transportation to the factory.

The main question now is, *given a climate and soil adapted to the growth of sugar beets*, can and will the farmers raise the beets in such quantities that they can sell the beets (with a *reasonable* profit for themselves) to a factory at a price it can afford to pay? This must be settled once for all, for if the farmers lose money they will surely cause the failure of the factory, and it would have to close its doors for want of material. *This is the unsolved problem for Oregon*, and the one that must be solved before capital can be interested sufficiently to build sugar factories. To be sure, as has been suggested, we should move cautiously, but this does not necessarily mean slowly. By concerted action of the farmers many questions can be answered in a year or two, which would require years under the present slow method, and the State would the sooner reap the benefit of the sugar bounty. Here is the opportunity for all farmers' organizations and agricultural societies to unite and solve the problem in a business way. In all efforts along this line this Station stands ready to aid the farmers in whatever way it may be able. A sugar plant involves a large amount of capital and cannot be interested by guesswork. All reports *must be based upon actual results*, and it is hoped that many will signify their willingness to aid in solving this problem for the State.

Experiments For 1892.

It is proposed to extend these experiments this year with a view of obtaining more definite facts concerning production and cost, and we wish to enlist such farmers as will carry out directions carefully and continue to the end, reporting at the end of the season the actual facts, giving in all cases correct answers to the list of questions furnished. Directions for cultivation will be furnished as well as a limited amount of seed to those who will signify their intention and desire to co-operate with the Station in

this work. The seed furnished will be sufficient to sow a small portion of an acre, and it will be of the best imported varieties. The Station will pay express charges on all beets sent in for analysis by any person who shall before May 1 st notify the Chemist of his intention to join in the work, and faithfully report.

That there may be no misunderstanding as to the report, it is given below.

Report of Sugar Beet Experiments.

1.—Name..... 2.—County.....3.—Post office..... .....

4.—Variety .....

5.—Date of planting.....

6.—Date of harvesting.....

7.—Character of soil .....

8.—Amount of cultivation.....

9.—Weather .....

10.—Amount of land used.....

11.—Amount of seed used.....

12.—Distance between rows.....

13.—Distance between beets in row.....

14.—Length of row gathered.....

15.—Number of beets in ffathered row.....

16 —Weight of beets.....

17.—Yield per acre.....

18.—Actual cost of crop.....

19.—At what price per ton could you afford to raise beets in quantity?

20.—Were beets troubled by any insect or other pest ?.....

21.—Remarks.....

NOTES—Answer all questions; under cultivation give full data; for calculating yield use following method which is that used by Dr. Wiley for making his calculations.

"When the beets seem to be mature select an average row" and gather every plant along a distance which should vary as follows, according to width between rows;

From	rows	16	inches	apart	gather	75	feet
"	"	18	"	"	"	66 2/3	"
"	"	20	"	"	"	59.8	"
"	"	22	"	"	"	54 3/4	"
"	"	24	"	"	"	50	"

The number of beets growing in the row, of the length above mentioned, must be counted. The tops are then to be removed, the beets carefully washed free of all dirt, wiped and weighed. When the row is not long enough to meet the conditions, take enough from the adjacent row to make up the required length. The number of beets harvested multiplied by 435.6 will give the total number per acre. The total weight of beets harvested multiplied by 435.6 will give the yield per acre "

Citizens of Oregon raising beets from seed obtained elsewhere are also requested to send samples for analysis, and to report according to the above form. If there are several samples from different varieties of seed a report should be sent with each. Extra blanks will be sent upon application. No beets will be analyzed unless the cultivation, yield and cost per acre are given. Address all communications and samples to

G. W. SHAW, Chemist Exp't Station,
Corvallis, Oregon.

APPENDIX.

Sugar Beet Experiments of 1890.

As stated in the previous paper, experiments were carried on during the season of 1890 with the sugar beet, and as no bulletin setting forth the results has been published the analyses, etc., are given in the following pages.

It is but fair to state that these experiments were commenced under the direction of Prof. P. H. Irish, formerly chemist of the Station, and the analyses given under the date of 1890 were made by him. The writer, then, waives all responsibility for the work previous to 1891, and only the bare facts as shown by the memoranda in the possession of the Station so far as they could be collated.

At the beginning of the season, beet seed was obtained from E. H. Dyer, Alvarado, Cal., and the Department of Agriculture at Washington, which was sent to a number of persons who had previously consented to raise the beets in co-operation with the Station. Instructions for cultivation were sent with each package of beet seed and the farmers were urged to follow the instructions as closely as possible. The results obtained, as shown by the beets that were sent to the Station for analysis, showed that in many instances the directions were not carefully followed, yet they were quite encouraging considering the circumstances under which the beets were grown.

Too much reliance cannot be placed upon the figures as this was the first attempt to raise beets and they were often found *too large*. A complete analysis of the beets was not made owing to a lack of working force at the Station, and the large amount of other work that was crowding.

In only a few cases was the weight of the beet recorded, or at least the present chemist was unable to find any data except for the few cases mentioned in the following

TABLE.

NAME OF GROWER.	County.	Av. Weight of Beets in Grams.	Per Cent. of Sucrose.	Soil.
1.—G. W. Mitchell	Washington	1107	11.00	Clay Loam
2. —A. R. Shipley	Washington	1305	10.05	.....
3.—Geo. Rogers	Polk	940	11.50	Clay Loam
4.—H. C. Perkins	Lane	595	8.50	Beaverdam
5.—Clark Walters	Umatilla	501	11.75	.....
6.—W. C. Cusick	Union	512	12.05	Alkali
7.—Wm. Brazleton	Benton	289	16.00	Tideland
Average	.....	749.+	11.77	.....

It is well to call particular attention to the wide variation in the percentage of sugar, and to notice the high per cent. of sugar from the beet grown on the tidelands. Whether these lands have any close connection with the amount of sugar remains to be seen from further experiments.

ANALYSES AND CULTIVATION NOTES FOR 1890.

The following is a table showing in brief the particulars, so far as could be ascertained, of the examination made in 1890.

Laboratory Number.	NAME OF GROWER.	County.	Percent. of Sugar.	Percent. of Dry Substance.	CULTURE NOTES.
1 & 2	P. H. Irish	Benton	8.41	19.45	
54.	E. T. Hatch	Polk	13.75	19.45	Planted May 9. Horse cultivated 4 times; by hand 3; weeded 3 times.
55.	A. W. Lucas	"	11.75	17.12	Horse cul. twice; hand twice; weeded twice. Troubled by gophers.
61.	Geo. Rogers	"	11.50	.....	Planted May 2; clay loam. Hand cultivated 3 times; weeded twice.
56.	J. Voorhees	Marion	13.75	21.31	Hand cultivated 3 times; weeded twice.
57.	Carl Hoffman	Douglas	11.35	19.22	Planted April 14; weeded twice.
59.	Geo. Mitchell	Washington	11.00	16.48	Horse cult. twice; hand cult. 4 times. Clay loam soil. Planted May 15.
60.	A. R. Shipley	"	10.50	.....	Horse cul. 2; hand 1; weeded 1; sandy loam, strongly tinged with iron.
62.	H. C. Perkins	Lane	8.50	.....	Hand cultivated twice; weeded 3 times. Beaverdam soil.
63.	Clark Walters	Umatilla	11.75	.....	Hand cultivated 3 times; weeded once. Planted April 16.
64.	Wm. Cusick	Union	12.05	20.07	Hand cultivated 3 times. Alkali soil.
65.	Wm. Cusick	"	13.90	21.30	Hand cultivated 3 times.
66.	Wm. Brazelton	Benton	16.00	23.18	
67.	Walters & Rawson	Wasco	8.40	15.90	Hand cultivated 3 times; weeded once.
68.	R. W. Scott	Clackamas	11.30	18.51	Horse cultivated once; hand cultivated 3 times.
69.	J. H. Steward	.....	5.50	11.23	
70.	W. E. Smith	Malheur	11.40	17.17	Hand cul. 4 times; horse cul. 4. Insects troubled them. Planted May 14.
71.	Thos. Daniels	Clackamas	11.66	20.19	Hand cultivated 4 times; weeded 4 times.
72.	J. C. Skelton	Malheur	9.85	.....	
74.	John Henry	Washington	8.50	16.87	Planted May 8. Beaverdam.
75.	John Henry	"	11.15	18.75	Planted May 8. Loam.
73.	W. G. Day	Lane	10.15	16.73	Planted May 1. Sandy loam soil.
76.	Edw. Albright	Jackson	10.50	21.04	Planted Mar. 28. Granite soil, manured. { Both planted 14 inches apart,
77.	Edw. Albright	"	11.40	.....	Planted Mar. 28. Alluvial soil. { and irrigated 3 or 4 times.
78.	C. P. Fullerton	Benton	11.25	18.60	
81.	" "	"	12.65	19.08	
82.	" "	"	12.25	17.92	
80.	Boyd Hamilton	Linn	9.75	10.16	Cultivated by horse 3 times; by hand 2 times.
72.	J. C. Skelton	Malheur	9.85	.....	Irrigated 3 times. Cultivated by horse 3 times. Beaverdam soil.
79.	C. P. Fullerton	Benton	9.35	15.72	
	Mean		11.11	18.15	

The season was particularly dry and a number to whom seed was sent reported that the dry weather had ruined the beets. In nearly all cases weather was reported as very dry, even when the beets were sown, hence it will be seen that the beets were not grown under the best conditions. Below is given a few quotations from letters from persons who grew the beets.

In relation to No. 70 Mr. Smith says: "The seed was planted on May 14, in rows about 20 rods long and 20 inches apart—furrows made with shovel plow between rows for irrigation. Seed came up fairly well, and grew first-rate during the season. Irrigated and hoed them as they seemed to need it. Soil, a part sandy loam, and a part a strong alkali, baking very hard after being wet. You will notice that some of the specimens have blotches on them similar to scab on potatoes, indeed, potatoes growing alongside of beets are very scabby."

Of No. 64, Mr. Cusick writes: "The one marked 'A' was grown on alkali soil; soil so strongly impregnated that last season I could raise no potatoes thereon. This season alongside of them wheat was grown and a large growth of straw was produced, but the grain was of a poor quality..... Neither sample was irrigated nor manured, but both on good soil, barring the alkali in one."

Mr. C. P. Heald, of Hood River, wrote as follows under date of August 28:—"The cut worms have destroyed every plant in one patch of the beets, and there are but a few weak plants left in the other bed which were overlooked by the cut worms, for the reason, I suppose, that they were so small. The ground was literally alive with the pests, and I could make no headway against them."

The above experiment can only be considered as preliminary, yet all things considered they are sufficiently encouraging to warrant further experiment. It will be seen from the preceeding page that the conditions were more favorable in 1891 and these as well as the fact those co-operating knowing better what was desired of them made a better showing in all ways. It will be seen that in the experiment of 1889–90 there were very few beets showing a paying quantity of sugar, whereas nearly all the beets of 1890–91 show a workable amount. This fact is very significant when it is remembered that Oregon is yet comparatively unacquainted with the best methods of treating the beet.

In this connection let us use the words of Mr. E. H. Dyer, taken from a circular sent in 1885 to the members of Congress. In relation to establishming the industry in California, he says:—"One of the greatest obstacles we had to contend with, was to induce the farmers of California to cultivate beets in a manner to be profitable to manufacture into sugar. we had to convince them that beets raised properly for sugar were not exhaustive to the soil, We have, at this time overcome most of the farmers prejudices, and now have no difficulty in obtaining an abundant supply of beets, cultivated properly for sugar. Our farmers have ascertained by actual experience, that beets are very desirable to rotate with other crops; cereals raised on land planted to beets the preceeding year give large returns."

Oregon Agricultural Experiment Station.

Bulletin No. 18. March, 1892.

ENTOMOLOGY.

F. L. WASHBURN, Entomologist.

Insects Injurious to Young Fruit Trees. Codling Moth. Kerosene Emulsion. Wire Worms. Flea Beetles.

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

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Insects Injurious to Young Fruit Trees.

As a consequence of the very general fruit tree planting at present in vogue in many parts of Oregon, numerous inquiries relative to insect pests found upon young trees have been received at the Experiment Station. Very many of these questions could be answered by reference to Bulletin No. 5. Unfortunately the edition of that is completely exhausted and in the present Bulletin there are descriptions and figures of a number of species which were discussed in the former publication. They are repeated here in order that the many who did not get No. 5, may acquaint themselves with the pests described therein.

It must, by no means, be inferred from the heading, that the following list does not affect mature trees also. This title is employed simply to emphasize the necessity of diligence on the part of the fruit grower at a time when the trees are least able to resist insect attack. For reasons of economy we will be as brief as possible in the treatment of the subject. Figures 1, 2, 4, 8, 9, 11, 12, were produced from cuts courteously loaned by the California State Board of Horticulture

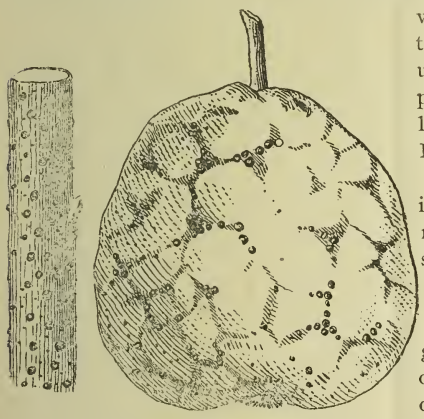


FIG. 1
Pear and twig infested with San Jose Scale.

Wherever straight lines occur in the figures they indicate the natural size of the insect by the side of which they are placed.

San Jose Scale.

Female scale round, flattened, gray, with center yellowish, about one tenth in. in diameter. Scale of male smaller, darker and slightly elongated, The eggs hatch about the time the cherries are turning red and the young insects migrate over the tree, soon becoming fixed and secreting scale. This scale is becoming

alarmingly abundant in Oregon. It has been found on other than fruit trees, and is undoubtedly carried, in larval stage, from orchard to orchard and tree to tree by winds, by birds, by bees and other insects.

Branches badly affected with this scale look reddish, and leaf and fruit, if scale is found thereon, show small red rings on their surface about the insects. This is a peculiarity characteristic of this scale. The sapwood of badly infested trees is found to share this red color.

REMEDIES.

Inasmuch as the young hatch at different times and the scale can be found in all stages during the summer, remedies applied during the warm weather are not satisfactory, and the fruit growers strongest hold is the winter wash of lime, sulphur, and salt.

Recipe for Winter Wash.—a. Boil 10 lbs of lime and 20 lbs of sulphur in 20 gals of water until all the sulphur is dissolved.

b. Mix 15 lbs of lime and 15 lbs of salt and add enough water to make 60 gals.

Add *a* to *b*. Mix well and strain through burlap. Spray affected trees with the solution, warming it to about blood heat.

A nozzle with a large orifice would have to be used, otherwise it will clog the aperture.

Recipe for Summer Wash.—a, 10 lbs Whale oil soap, 20 gals. of water.

b. 1 lb Am. concentrated lye 2 lbs sulphur 1 gal of water.

When *a* is heated enough to become thoroughly liquid and *b* has been boiled until it is thoroughly mixed and dark brown, add *b* to *a* then heat for half an hour, add 30 gals of water, and use at a temperature of about 110° Fahr.

Through May, June and July is the best time to use this spray.

It is also effectual in lessening the injury caused by the apple scab, (*Fusicladium dendriticum*) and is sure death, when used thoroughly, against the branch form of Woolly Aphis; Green Aphis succumbs to it at once, and when sufficiently diluted we have used it successfully against the Cabbage Louse on Cabbage, Cauliflower, Kale and Brussels sprouts, without injury to leaves. A number of insect enemies prey upon the San Jose Scale.

Should young trees be received affected with this or any other scale, they should be disinfected before planting.

Dipping them in a solution of 1 lb. Am. concentrated lye to every 2 gals. of water isrecommended. It would seem that a moment's immersion in the wash recommended for summer use against this scale (120° Fahr.) would accomplish the desired object. We have never had an opportunity to test this; as a matter of fact the sale of such trees is against the law and is punishable by a heavy fine.

Oyster Shell Scale.

In shape the female of this scale resembles a mussel shell, is grayish brown, about ⅛ of an inch long. The scale of the male is straight and much smaller than the female. The eggs hatch into tender yellow lice about the time the trees are blooming, and before.

REMEDIES.

Scrape mature trees well in winter to get rid of old scaly bark. Examine young trees before planting and clean if infested. In summer, use

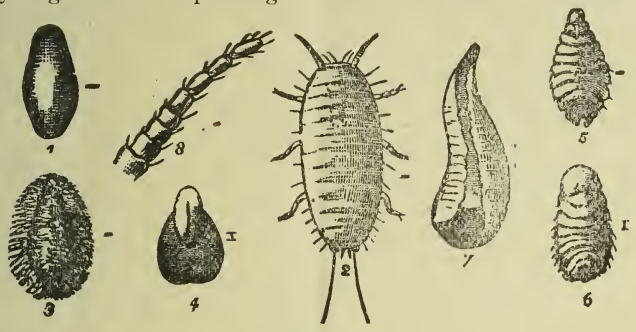


FIG. 2.

OYSTER SHELL SCALE.—1, Egg. 2, Young Insect. 3, Young, with secretion forming scale. 4, A form of the scale before it reaches maturity. 5 and 6, Appearance of Insect after moulting. 7, Mature scale. The lines indicate the natural size of insect.

wash recommended above for San Jose Scale, when lice are hatching, or kerosene emulsion. After scraping trees apply the wash recommended below for apple tree borers.

Woolly Aphis.

Found in woolly clusters on our apple trees. Everywhere too common. A root form infests the tree below the ground and there is thought to be a

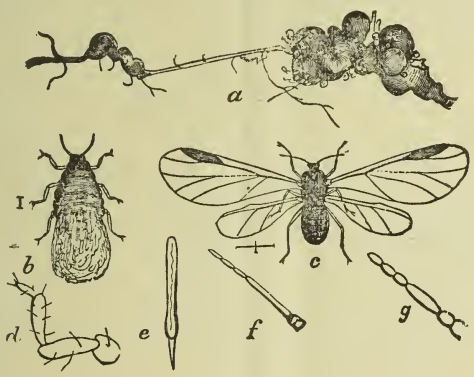


FIG. 3.

WOOLLY APHIS.—*a*. galls on root. *b*. larva. *c*. winged female, *d*. leg, *e*. beak. *f*, antennæ of female. *g*. antennæ of larva.

migration from root to branch. This insect ruptures the bark of the branches and causes gnarled condition of the roots, sapping the tree's vitality and affecting its bearing qualities.

REMEDIES.

Old and valueless trees which are badly infested should be destroyed by burning root and branch. If the colonies on branch are few, a feather dipped in pure kerosene and applied to each colony will kill them. Or if

very few they can be crushed with the hand. In summer they can be killed by spraying forcibly and frequently with the summer wash recommended for San Jose Scale, applied warm.

Trees treated with this wash last summer (see report of work with the Codling Moth) were practically exempt from the branch form of Woolly Aphis as long as spraying continued, though they had been badly affected in previous years.

The following Rosin Solution will kill them. It is also good for other Aphidæ, when used at one half the strength here indicated.

Rosin Solution.—Dissolve one pound of Am. concentrated lye in two quarts of water, add 4lbs of rosin, heat until dissolved and then add 2½ gals. of water.

Use as spray when warm (100° F.), diluting it by adding 1 gallon of water to every quart of the solution. To kill their winter eggs and eggs of any of the Plant Lice (little, oval, shining black bodies found in clusters about bud axils) use 1 pound Am. concentrated lye to every 2½ gallons of water. Never use this wash on any tree after the buds begin to swell.

For root form, lay bare the roots, pour some soft soap, slightly thinned, over them, and cover them with soil other than what was taken out. Or, heap unleached ashes and lime about base of tree. Gas lime spread about the tree (about two shovelfuls) so as not to be in contact with the bark, is said to be excellent. The use of bisulphide of carbon may prove efficient in connection with this form of pest.

This Aphis, as well as others of the same family, are preyed upon by parasites and many beneficial insects such as "Lady Bugs," Laced-winged Flies, Syrphus Flies, etc.

Western Peach-Tree Borer.

Sannania Pacifica.—Riley.

A steel-blue, wasp-like looking, clear-winged moth which flies in the day time. It lays its eggs on the plum, cherry and peach tree (or peach stock, whatever the tree may be) at or near the collar and the larva, hatching, bores downward in the sapwood and bark.



FIG. 4.
Western Peach Borer. Larva, and Male and Female Moths. Also Moth emerging from Cocoon.

The full grown worm is about 1 inch long, yellowish white with a red dish, brown head and strong brown jaws. The presence of the pest is indicated by exuding gum often mixed with sawdust-like castings.

It behooves all owners of peach or prune trees to be alive to the destruction which this pest can cause.

REMEDIES.

Examine collar and larger roots for borer twice a year, early in February and again in October. At these times dig the soil away and make a careful search, as the larvæ are often found way down among the larger roots. Remove borers, when found, with knife.

Wash trunk early in May and again six weeks later with the following:

Add 1 gal. of hot soft water to 1 gal. of common soft soap and stir in 1

pint of crude carbolic acid. When well mixed add ten gallons of soft water and enough lime to make the mixture a thin white wash.

Some entomologists recommend the addition of a little glue to this mixture to make it more durable.

At the Station we have wrapped (July 14, 1891), 7 trees with newspaper, several thicknesses, allowing it to project a few inches below the surface and to extend up to lower branches. Removed Oct. 8 and trees found exempt from borers. This paper should be applied earlier in the season. We have also painted the trunks and collars of a number of trees with the rosin wash, full strength, recommended under Woolly Aphis, with good resuls.

Flat Headed Apple Tree Borer.

A dark-brownish active beetle ½ to ⅔ of an inch long, under side with a coppery lustre. Its larva, a yellow grub about 1 inch long with a very large flattened head, attacks not only the base of the apple tree, but is found more or less over the trunk and is not confined to the apple but attacks pear and plum and occasionally the peach. Discolored bark which has a dried appearance almost always indicates the presence of the borer; often, too, the sap oozes out where the pest is at work, and the sawdust-like castings are seen either on trunk or at base of tree. The eggs are laid by the beetle in cracks and crevices of the bark and the young larva bores into the sap wood. Later it works in the more solid wood. It undergoes its transformations just beneath the bark.

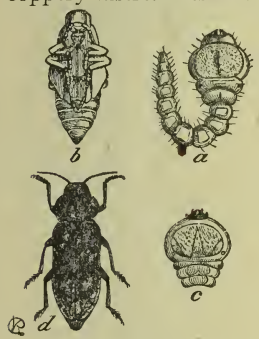


FIG. 5.

FLAT-HEADED APPLE-TREE BORER.—*a*. Larva. *b*, Pupa, *c*, Head of larva. *d*, Beetle.

REMEDIES.

Use the same precautions and remedies suggested for peach tree borer. Young trees newly transplanted and weak trees are more subject to attack, and it is a noticeable fact that the southwest side of the tree where the bark may have been injured by the hot sun, is preferably the place of attack.

Woodpeckers pick these borers from their hiding places and three or four parasitical insects are known to attack them.

Green Aphis, Peach Aphis, Plum Aphis.

The Green Aphis (*A. mali*) is found on the apple. The Peach Aphis (*Myzus persicae*) are black, brownish, or yellowish ⅛ inch long. The Plum Aphis is green with blackish markings on abdomen. The name in each case indicates the food plant of the insect.

REMEDIES.

If but few colonies are observed in an orchard, perhaps crushing by hand is the most practical remedy. Spraying with kerosene emulsion No. 1 (see beyond under *Kerosene Emulsion*) in the proportion of 1 part emulsion to 25 parts of water will kill any of these without injury to the foliage. There is the greatest necessity for early treatment, before the lice get well started, and when their numbers are comparatively few. Spraying with strong soap suds or soap suds and tobacco is another summer treatment recommended. A forcible spray

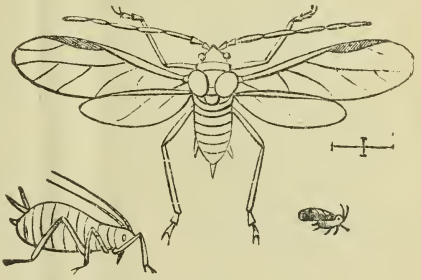


FIG. 6.

GREEN APHIS.—Winged and wingless forms.

should be directed against the under side of the leaves and every part where the insect may be concealed, should be reached by the spray. We have found that the Climax Nozzle, manufactured by the Nixon Nozzle and Machine Co., Dayton, Ohio, does good work against these and all other Aphids, inasmuch as it delivers the spray with great force. To destroy winter eggs, see remedy under Woolly Aphis.

Pear and Cherry Tree Slug.

A dark green slimy worm about ⅔ inch long found feeding on the leaves of pear, cherry and other trees. It eats the upper side of leaf, causing it



SAW-FLY producing Pear and Cherry Tree Slug.



FIG. 7.
CHERRY LEAF, showing Slug at work. *a*, Larva, natural size.

to wither and fall to the ground. This larva undergoes its transformations in the ground, changing to a four-winged fly which lays its eggs on the leaves.

REMEDY.

Spray affected trees when foliage is full, with 1 pound good Paris green to every 250 gallons of water used. Five pounds of soap added to that quantity of liquid will help it to spread evenly over the leaves. Thoroughly mix these and keep them well stirred when using. This mixture cannot be used when the bloom is on, nor can it be used on cherry trees when the fruit is just starting.

Hellebore 1 oz. to 2 gals. of water is claimed to be an effective remedy, applied the same way.

Peach Moth.

Several terminal twigs of peach trees have been sent to the Station containing the pinkish larvae of the Peach Moth or Twig Borer, about ½ in. long. They affect the fruit of the peach and plum as well as the twigs.

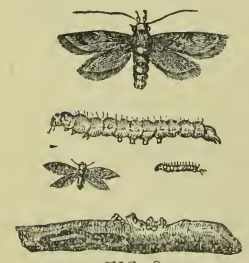


FIG. 8.
PEACH MOTH AND LARVA. Enlarged and natural size, and twig showing work of insect.

This insect is not likely to become a serious pest. The only sure remedy is to remove infested twigs and burn them.

Probably the summer wash recommended for the San Jose Scale would prove beneficial if a remedy were necessary.

In the east this insect feeds on strawberry roots.

WHITE-MARKED TUSSOCK MOTH.

Female moth wingless about ½ in. long brownish; male gray strikingly marked with darker colors and with white:

Caterpillar light yellow 1 in. or more long, head and two protuberances

toward posterior end of body, red. Four tufts on back yellowish white. One black plume extends from posterior end of body, two from the anterior

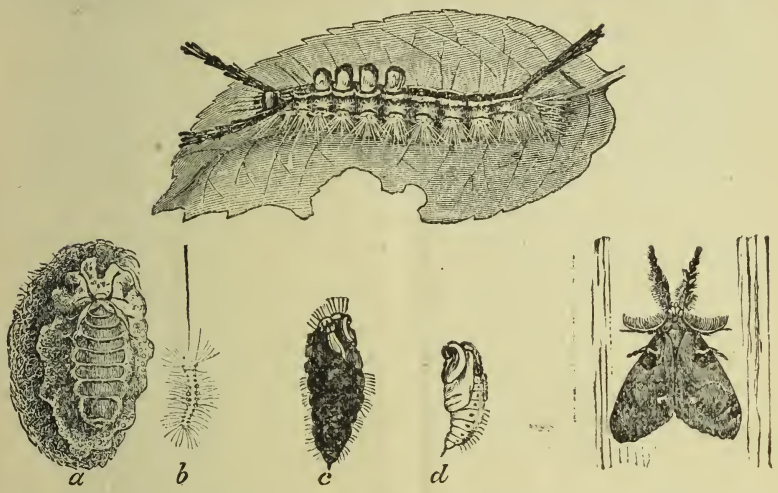


FIG. 9.
WHITE-MARKED TUSSOCK MOTH, CATERPILLAR ON APPLE LEAF.—*b*. a young caterpillar *c*. Crysalis of female. *d*. that of male. *a*. The wingless female shown on empty cocoon. The male moth is also figured.

end. Fine yellowish hairs on side of body. Egg masses found on a cocoon beneath a leaf fastened to branch of tree.

The larva being a leaf eater would naturally succumb to arsenical sprays used against the Codling Moth. It is by no means a serious pest.

Cut Worms.

The various colored larvæ of several night-flying Moths. Unfavorbly known as "cut worms" on account of their habit of cutting through the roots of many garden vegetables just below the ground, or through the stalk just above the ground. Some species also injure young fruit trees by climbing up the trunks and feeding on the tender buds and leaves.

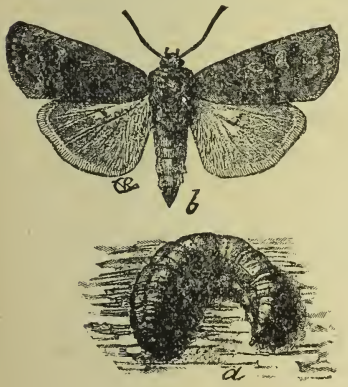


FIG. 10.
CUT-WORM AND MOTH.

REMEDIES.

Inasmuch as they lie concealed during the day in the immediate neighborhood of the plant attacked the previous night, when a young tree is observed to be newly injured, the orchardist should look for the depredator in the earth a few inches from the tree and one or two inches below the surface. Pieces of tin or zinc fastened round the tree in the form of an inverted funnel keeps them from ascending. Shaking the trees late at night and so jarring them onto a sheet below is one good means of collecting them. Numerous holes, about one inch in diameter and a few inches deep, punched in ground about trees will serve as traps into which some will fall and be unable to extricate themselves. Sprinkling the

leaves and buds with Paris Green solution (1 lb to 300 gals. of water) will kill them. Dipping bunches of freshly cut clover in the solution of Paris Green and scattering same about trees will poison many. In preparing these baits the solution might with profit be made stronger than the proportion given. After eating of this clover the worms burrow beneath the ground an inch or two and there die; one must not expect to find them on the surface.

Cabbage leaves, it is claimed, laid on the ground form attractive baits under which they conceal themselves and can be killed in the morning.

Gardeners will readily see which of the above remedies are applicable in vegetable gardens.

Divaricated Buprestis.

A rough bronze colored beetle nearly 1 in. long. The wing covers at posterior end are slightly spread apart. Freqnently found sunning itself on limbs of cherry and peach. The larva or grub, which feeds on the sapwood closely resembles the flat-headed borer. Though reported as not especially troublesome, I have just taken (Mar. 9) from the collar of a peach tree, larva of this species over 1¼ inches long and in the same tree found two or three other specimens considerably smaller. The treatment recommended for the Peach Tree Borer would be efficacious here.

Red Spider.

(*Tetranychus telarius.*—Linn.)

Not a true spider, but a minute mite which sometimes swarms on branches of fruit trees. Their small eggs, colorless when laid soon turn reddish, making affected spots on branches, look as though covered with iron rust.

These little fellows spin delicate webs on the under side of a leaf and there feed on the leaf's juices. The leaves thus affected turn yellow. Quite recently some dried prunes were sent us covered with this pest.

REMEDIES.

Spraying with strong soap suds will destroy them, should they become troublesome; but said spray must be directed against under side of leaves until those parts are thoroughly wet. In winter the eggs can be destroyed by a wash of 1 lb Am. concentrated lye in 2½ gals. of water. Kerosene emulsion is disastrous to these animals, as is also any wash containing sulphur.

This little pest is frequently very troublesome on green house plants, and is reported as injuring the hop vine.

Tent Caterpillars.

Hairy caterpillars spinning webs on forest and fruit trees. See Bulletin No. 14.

Canker Worms.

Smooth, naked caterpillars called "measuring worms" or "loopers" from their peculiar mode of walking. They are leaf eaters and could therefore be successfully attacked with the arsenical spray.



Branch and Twig Borer.

A small brownish beetle boring in axils of twigs on pear and other trees. See Bulletin No 14.

FIG. 11. Branch and Twig Borer.

Unicorn Prominent.

A leaf eating caterpillar, not common enough to cause special injury and seldom noticed because of its protective coloring. Hand picking, jarring trees, and arsenical poisons could be used against it.

Plum Tree Catocala.

A moth whose eggs produce a caterpillar 1½ in., whose body is thickened in middle. General color of caterpillar grayish brown with two to four small reddish tubercles on each segment. On upper part of ninth segment there is a fleshy horn ; on twelfth segment a fleshy ridge tinted behind with deep reddish brown. Leaf eaters, but not common enough to cause special injury.

Red-humped Caterpillar.

A leaf eating caterpillar a little over an inch long, emitting a strong dis-

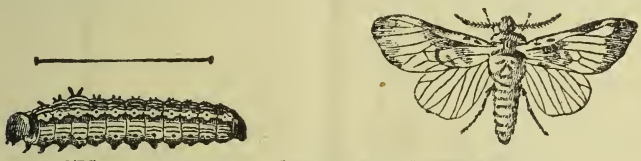


FIG. 12.—RED-HUMPED CATERPILLAR, LARVA AND IMAGO.

agreeable odor when handled. Head red and a red hump on fourth segment. Hand picking and jarring trees, for this and the preceeding could be resorted to if necessary.

Cicadas.

Different species of so called "Locusts" and among them the Seventeen Year Locust. The mature insect punctures the branches and in the slits so made deposits her eggs. The twigs and branches, thereby weakened, are broken by the wind. The larval and pupal stages are passed in the ground where the larvæ feed on the juices of the roots. They have not been reported to the Department as yet doing damage in Oregon.

Scolytid Borers.

The larvæ of very small snout beetles which not only destroy vast areas of forest but frequently attack fruit trees. A number of reports have reached the Station, accompanied by specimens, which bear evidence to this latter habit. Their presence in a tree in large numbers foretells its death. They work on trunk and branch and their mines are just underneath the bark. Frequently the course of their burrow is plainly indicated on the outside of the bark by a narrow, tortuous blister, as it were.

The whitewash recommended for the apple tree borer would act as a preventive in this case. We have before us now (Feb. 23) some of these larvæ transforming into beetles, indicating the necessity for early spring treatment.

Once in the tree the surest way to combat them is to cut off the branch, or trunk, below the affected region and burn it. It is fair to conclude that where young fruit trees are planted amongst timber, they may invite attack. We would suggest to those planting fruit trees in the midst of extensive tracts of timber, as on claims, that, if the forest in the vicinity is affected the best way to prevent the spread of the pest is, as far as practicable, to cut down all the dead and dying trees in the neighborhood, strip of the bark, and use it (the bark) for fuel. The loosened bark on forest trees newly affected should, if deemed practicable, be stripped off and burnt. Thousands of these minute larvæ can be found in one stump in felled regions. If the bark from such stumps be burned, the naked stumps do not

offer so great inducements. Such radical measures as outlined above would hardly be called for unless the pest became much more destructive than it is at present.

Round Headed Appletree Borer.

Use same remedies as for Flat headed borer. This species however confines its attacks to the base of the tree while the Flat headed Borer may be anywhere on the trunk and sometimes on the larger branches.

Pear Blight Beetle.

A very small dark brown beetle about one tenth of an inch long that works at the base of the pear bud, though occasionally found on other trees. Cut off affected twigs and burn them with beetles contained therein.

Purple Scale, Glover's Scale, Lemon Scale, White Scale.

One or more of these species are frequently seen on imported oranges and lemons. There is nothing in their occurence to especially alarm the Oregon orchardist, although they are a serious menance to the orange industry.

Some General Suggestions.

Thorough cultivation, thereby keeping trees vigorous, is one of the best means of preventing insect attack. All old and valueless trees badly infested with any insect pest such as scale, woolly aphis, borers etc should be destroyed by burning, as they form the supply house from which more valuable trees may receive the infection.

All rubbish should be kept away from an orchard and woodpiles will fall under this heading; their presence near an orchard is undesirable. Cut out of the trees all dead and dying wood. All fallen fruit should be fed to stock or destroyed.

Scraping off the scaly bark from mature or old trees and white-washing their trunks will do much to keep away insects. Take care that your newly planted trees do not get sunburned as such weakened spots are chosen by borers for the beginning of their operations. A shake on the southwest side of each tree will prevent this.

The Codling Moth.

A detailed report of the season's work with the Codling Moth will have to be reserved for a later bulletin. Briefly, it costs 7 cents per tree, labor and material, for each spraying, using the combined fungicide and insecticide employed the preceeding year, and 6 cents per tree if Paris Green and water alone are used. The labor, of course is the chief expense. In this experiment student labor was employed; where farm labor can be used the attendant expense would be less. We used, the past year, a Bean Spray Pump, manufactured by the Bean Spray Pump Co. Los Gatos, Cal., and for sale by Mitchell, Lewis & Staver of Portland, agents in this state. This pump worked admirably. As far as we have gone with it we regard it better than any pump we have tried. Equally good reports of its merits come to us from various fruit growers and farmers throughout the state. One of its chief recomendations is the ease with which it is worked

We had a sheet iron tank constructed, holding 125 gallons, which hooked onto a frame which, in turn, rested on a wagon bed. Below the tank, and inside the frame was a sheet iron stove, whereby the liquid could be kept warm if necessary. This tank, when not in the field fitted into a brick furnace, affording a means of heating any desired mixture, The nozzles used were the new Vermorel Cyclones manufactured by the Field Force Pump Co. Lockport, N. Y.

All fruit growers realize the necessity of spraying. Each general farmer,

however, must decide for himself whether it be practical or not in his special case but even though he has but few trees and raises apples for his family alone, the satisfaction of having clean smooth fruit without blemish, should prompt him to the slight effort and expense necessary.

Oregon apples are bringing at wholesale in Sacramento market, at this date Feb., $.90 to $1.50 per box and in some fruit raising districts in Oregon, Medford for example, farmers receive from 40 cents to 50 cents for apples which are shipped to California, the commission men furnishing boxes and packing. Portland commission houses are paying 75c to $1.50 per box, and there is a good retail trade in our smaller cities at 50c to $1,00 per bushel. In last year's report (see tables Bulletin 10) it was demonstrated that from 70 per cent. to 90 per cent. of fruit can be saved by spraying with Paris Green. It is evident that at least four and probably more sprayings are necessary in most parts of the State where the moth is established.

Kerosene Emulsion.

The general usefulness of this agent cannot be too strongly emphasized. It is, without doubt, one of the most powerful agents known to the agriculturist. Simple in composition, when properly made and rightly used, it is sure death to very many insects and causes no injury to foliage. It is especially good for use against the various species of plant lice. There are two or three ways of making kerosene emulsion, viz:

NUMBER 1.

The Riley-Hubbard Emulsion.—One half pound of hard soap dissolved in one gallon of water; while boiling hot remove from the fire and add 2 gallons of kerosene (any cheap brand) and agitate immediately by forcing through pump and back into vessel. After a few minutes of this work the emulsion should form a creamy mixture.

One part of this to 12 parts of water is recommended for the various plant lice. It would doubtless have to be made weaker for trees with very tender foliage. In every case it is well to test it on foliage to which it is to be applied, before using. With some kinds of hard soap this will not dilute readily with water unless it be heated, and if it be diluted with hard water the oil may rise to the top of the mixture. These are the only objections to this emulsion.

In experiments at the Station we used this emulsion, but substituted whale oil soap for the hard soap recommended and diluted with hard water. On September 23d, 1891, we sprayed a row of cauliflower badly affected with cabbage louse with this emulsion slightly altered as indicated, using one part of emulsion to 25 parts of water, with the effect of killing the lice and not injuring leaves. A number of cabbage plants infested with this aphid were also sprayed with the same strength, also a branch of a Grindstone Pippin infested with Green Aphis. In each case the lice were killed and foliage not injured.

Cabbage plants, young and old, were being injured at this time by the Cabbage Moth, *Cerastoma brassicellæ*, which, however little harm it may do to mature plants, can, by attacking young plants, very seriously impair their growth.

The larva is a slender green worm about ½ inch long eating many ragged holes in cabbage leaves. It spins its cocoon and undergoes its transformations on the leaf. The same solution was used against this insect with perfect success. Pupæ which were drenched with the spray were killed. The spray should be directed against these pests and against aphids *with great force.* We find the Climax Nozzle the best suited for this purpose. Atten-

tion has already been called to the necessity of beginning treatment against all plant lice early in the season before they get well started.

In this experiment we diluted with cold hard water, and after standing some time a part of the oil rose to the top. *When this occurs it should be skimmed off, as pure coal oil is fatal to vegetation.* Soft water should always be used with this emulsion if possible.

Prof. C. V. Riley, U. S. Entomologist, recommends this emulsion for the Hop Louse, 1 part emulsion to 25 parts of water, and it has proved of great benefit in this direction.

In Bulletin No. 10, from this Station, kerosene emulsion, 1 part to 30 parts water, was recommended as a good spray for the hops, and for plum trees in the spring before the louse had migrated to the hops.

From answers to many inquiries sent to hop growers of this State, we learn that it was tried the past season in many cases, and generally with success, though several reports came in of its failure. Such failures must be ascribed to the fact that it was not, in those cases, properly made or properly used. Under the right conditions it is a perfect success.

We are prompted here to mention the fact that a prominent hop firm in Washington State is issuing a circular to the effect that an extract of quassia chips is the only remedy for this pest and denouncing kerosene emulsion as of no value against the hop louse. This is both unjust and untrue as repeated experiments have proven.

Hop growers should have ready for use in spraying their yards a Cyclone nozzle with *side* discharge piece in order to reach the under side of the lower leaves. These nozzles are for sale on this coast.

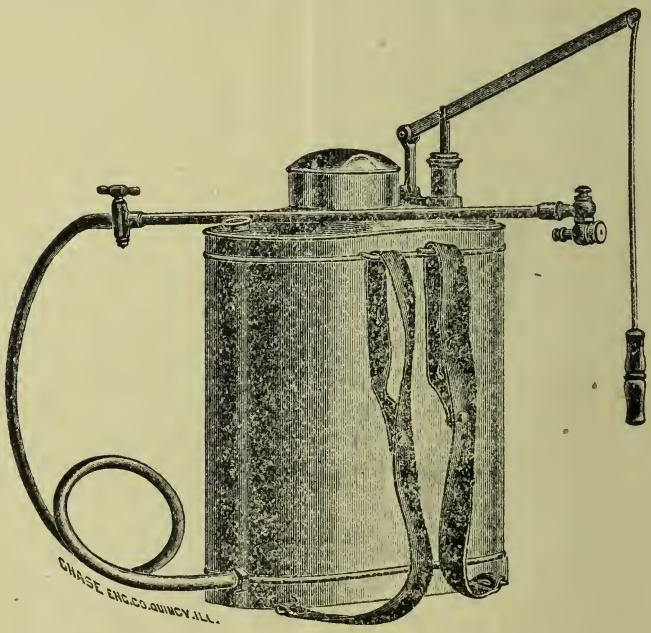


FIG. 13.—EXCELSIOR KNAPSACK SPRAYER.

Knapsack sprayers which fit on one's back are handy in spraying small yards or small orchards. Fig. 13 represents one sold by Wm. Stahl of

Quincy, Ill., for $14. Another is manufactured by the Field Force Pump Co., Lockport, N. Y., and sold at the same price.

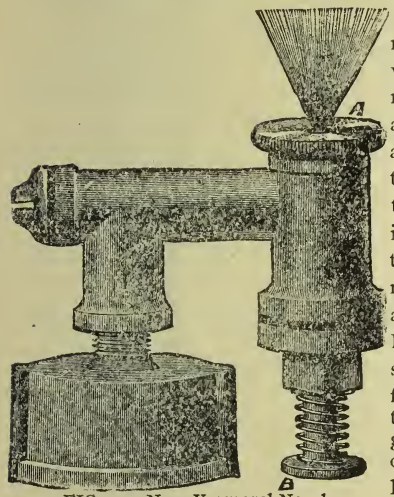


FIG. 14.—New Vermorel Nozzle.

Fig. 14 illustrates the new Vermorel nozzle which has given satisfaction with us during the past season. It is made by the Field Force Pump Co., and sells for $1.75 post paid. It causes a fog-like spray similar to that obtained with the Cyclone. Its advantage, however, over other nozzles lies in the fact that anything which clogs the aperture at "A" can be instantly removed by pressing the thumb against the cleaning needle "B." Furthermore the nozzle can be unscrewed in the centre, as indicated in figure, and a slender stream thrown to the top of very high trees. We regard it as a most excellent nozzle for orchard use, barring the rather high price.

Another form of emulsion we will call

NUMBER 2.

Hard Soap Kerosene Emulsion.—Hard soap ¼ lb dissolved by boiling in 2 quarts of water; add one pint of kerosene and agitate with force pump as before. Then add an equal amount of hard or soft water (that is, 2½ quarts) and it is ready for use.

An objection to this is that it becomes, with some soaps, lumpy and stringy when cold and sometimes has to be heated before it can be diluted further.

NUMBER 3.

Soft Soap Kerosene Emulsioa.—Soft soap 1 quart, dissolved in 2 quarts of boiling water. Remove from fire and add 1 pint of kerosene and agitate with force pump. Then add an equal amount of hard or soft water.

The advantage of this emulsion lies in the fact that it can always be diluted with cold water either soft or hard. Prof. Cook, of Michigan, in a recent bulletin, says this sometimes injures the foliage, which fault can be remedied by using one half the quantity of soap (i. e. 1 pint). When this is done add only 1¼ times the amount of water, not twice the amount. In this and the preceeding the amount of kerosene is to the whole emulsion about as 1 : 15.

Wire Worms.

Yellowish or reddish or brown nearly round, hard larvæ (worms) with six legs, and of various lengths, species of from ¾ to 1⅓ in. being the more commonly found. After two, three, or more years they turn into Click beetles or snapping beetles; so called, because if placed on their backs they snap themselves up and over with a clicking noise. They are found

in low moist land, especially land that has lain in clover or grain for some time. They must not be confounded with centipedes which have legs on either side the entire length of the body, nor must they be confused with species of *Julus*, "earwigs" as they are called, comparatively harmless animals which look like round, hard, dark brown worms with very many small legs. These earwigs, when disturbed will coil themselves up and remain motionless; they crawl about at night; during the day they are found hiding in moist places under old boards or logs and frequently in the vicinity of bruised or spoiling fruit.

On May 22 last, finding that wire-worms were taking the bean plants on the experimental grounds, we cut potatoes into pieces 2 in. square, removed the eyes that they might not sprout, impaled each one on a stick, and buried them 2 in. below surface and one or two inches from bean plant, apportioning one or two pieces of potato to each hill. These pieces were examined every day or two and a large number of wire-worms were taken from them during the week the experiment lasted. This is only practical on a small scale, of course. Where large areas of wheat or a number of acres of vegetables are affected another remedy is called for.

Potash salts are rapidly coming into favor, not only as fertilizers, but also for their insecticidal qualities. We have received some Muriate of Potash and Kainit of Potash and propose trying their effect on wire-worms and cut-worms both serious pests in Oregon. We should be pleased to send small packages of the above salts to any one personally known to members of the Station force, who is willing to co-operate with us by experimenting on their own land and reporting results. Only a limited amount can be disposed of in this way. We should expect consignee to pay the small attendant express charge.

Flea Beetles.

May 20, 1890, our radishes were badly affected with these beetles and a portion of them were liberally sprinkled with a solution made by boiling 1 lb of waste tobacco stems in 2 gallons of water. Within a week from treatment these plants showed a wonderful increase of growth, in marked contrast to those not treated. Examination of the roots of the treated and untreated plants disclosed the fact that on those not treated the six legged larvæ of flea beetles were working on surface of root, and in some instances had eaten below the surface.

In other instances, surrounded by a crust of earth, they were evidently preparing to pupate. Those treated with tobacco water were barely, if at all, affected, and later these treated plants developed fine, large, smooth roots.

The secret of success here lay largely in the fertilizing qualities of the tobacco, enabling the plant to get ahead of the ravages of the beetle; for, when the leaves are well advanced this pest forsakes them for more tender food. Then, again, the solution, absorbed by the earth around the roots, naturally made the surface of the root distasteful to the insect.

We have also treated tomato plants with Paris green and water (1 lb to 200 gals.) with no bad effect to the plant and with some good effect on the beetles, but owing to a number of objections, and the superiority of the tobacco treatment, we would not recommend this. It is claimed that kerosene emulsion is good for the flea beetle. It is well worth a trial.

The following remedies are recommended: Dusting leaves with Pyrethrum (too expensive), dusting with soot, with ashes. Dusting with ashes, we find, only affords a temporary relief. Sprinkling plants with a strong tansy tea made by boiling the leaves in a sufficient amount of water to cover them.

A number of applications of the tobacco solution may be necessary.

Oregon Agricultural Experiment Station.

Bulletin No. 19. May, 1892.

BOTANICAL DEPARTMENT.

Some Oregon Weeds and How to Destroy them.

MOSES CRAIG, Botanist.

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

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SOME OREGON WEEDS.

We desire in this bulletin to call the attention of Oregon agriculturists, and others interested, to the large crops of weeds annually grown on their farms and to assist them in getting rid of these pests. Everyone knows that a weed is simply "a plant out of place," or as Webster puts it one that is troublesome or useless, few however have a definite knowledge of the habits of growth of these intruders or know how to most effectually destroy them.

ENEMIES TO AGRICULTURE.

Weeds, insects and fungous diseases are the worst enemies to successful agriculture, and it is evident that some knowledge of their nature and habits is necessary to all who would successfully combat them. The more thorough our knowledge of these plants the more effectual will be the means we employ to destroy them. There are three questions concerning weeds that are of great practical interest to the farmer, namely: How weeds get on a farm, the character and amount of injury they are likely to cause, and how to best destroy them.

HOW WEEDS GET ON THE FARM.

The subject of plant distribution is an interesting one and

may be considered under two heads, first the provisions made by nature which may be either structural or physiological and second the natural forces that act as aids in distributing the plants. Under structural provisions we may have modifications of the fruit such as pappus of which the thistle down carried by the wind is a familiar example, hooks as in the Burdock (*Arctium*) by which the burs fasten themselves to the hair of animals and are thus carried from place to place, or modifications of the seed as in the coma or hair of Cottonweed (*Epilobium*) and Milkweed (*Asclepias*).

Under physiological provisions we may have prolonged vitality of the plant, a seed covering attractive to birds, or a sticky exudation as in the Tarweed (*Madia*). Of natural forces aiding in the distribution of plants we may name, winds, streams, birds, cattle and last though not least the agency of man.

That railroads are a great factor in weed distribution is apparent to all who have noticed the great number and variety of Eastern plants growing along these lines of traffic. The seeds of many plants are annually emptied upon our shores in the ballast left about sea-ports by vessels from foreign countries, or come over the mountains in the straw and chaff used for packing goods. Some of our worst weeds are thus brought from a distance but many come from neighboring fields or roadsides and by ocupying valuable space and appropriating food from the soil lessen the yield of crops and if allowed to ripen seed will reappear in greater numbers the next season.

CO-OPERATION IN THE DESTRUCTION OF WEEDS.

Sometimes they spread so rapidly as to require concerted action to destroy them; to this class belongs the Canada thistle which spreads both by seeds and by underground stems rendering its destruction very difficult where it is once established. The diligent farmer may free his farm from weeds one year, only to find that a shiftless neighbor has raised a crop of Thistles or Dog's Fennel to reseed his farm and necessitate a yearly repetition of this labor. No wonder the farmer becomes discouraged after a few years experience of this sort and soon his fields are as bad or worse than his neighbors.



PLATE IX.—Sow Thistle. (*Sonchus oleracea*, L.)



PLATE III,—Tarweed. (*Madia sativa*, Mol.)

VITALITY OF SEEDS.

There are some weeds whose roots or seeds seem ever in the soil ready to germinate and grow whenever a favorable opportunity offers. The opinion prevalent among some farmers that wheat turns into cheat arose in this way: Chess seeds often remain in the soil several years before germinating, if for any reason the wheat crop failed and chess seeds already in the ground came up the natural though erroneous inference was that the wheat had run wild or turned to chess.

FRUITFULNESS OF WEEDS.

Most weeds are propagated by seed which is produced in great abundance and modified in various ways to aid in the distribution. As an illustration of the fruitfulness of weeds we estimated the number of seeds on a single plant of Moth Mullein (*Verbascum Blattaria*, L.) collected in Linn county. It bore ninety-five flowers and ninety-one capsules, three of these were selected and the seeds carefully counted, they averaged three hundred and thirty seeds apiece. Assuming that the flowers are all fertile and yield in the same proportion we have 61,380 seeds as the product of a single plant and there were several hundred of these plants in the field: What a harvest the owner will reap next year!

GENERAL RULES FOR KILLING WEEDS.

The method of destroying weeds varies with the nature of the plant but some general rules may be given. Annuals, that is plants living only one year, can easily be destroyed by keeping them mowed or by plowing them under. Sometimes the seeds remain in the ground for a long time without germinating, if the conditions are unfavorable, but a little care for a few years in removing all plants before any of the seeds ripen will gradually rid a place of them. Biennials may be destroyed in the same way, but perennials, that is plants living for several years, are more difficult to dispose of, if however they are kept cut close to the ground and not allowed to develop their leaves which have been compared to the lungs of animals they become weakened, the other plants get a start and choke the weeds out. Cutting when in flower will kill many weeds. Cultivation in a dry time and when the plants are growing is most injurious to weeds and beneficial to crops. Avoid the introduction of weeds in manure, or litter, or from weedy surroundings. After a summer crop has

ripened sow some crop to cover the ground and keep weeds down. Give clean cultivation every few years either with a hoed crop or a fallow. Keep ground well occupied with crops. Keep meadows and roadsides well seeded and plow-land cultivated unless shaded by crops. Weeds are not only unsightly but they occupy valuable space crowding out crops from which they take moisture and nutriment and thus lesson the yield. Remember that "an ounce of prevention is worth a pound of cure" and that "one years seeding is seven years weeding," so always sow pure seed. Unless one can readily distinguish good seed from bad he should purchase his seed only from reliable firms. Good seeds are smooth, shiny, full and heavy, readily sinking in water and popping like corn when placed on a hot stove.

OREGON LAWS FOR EXTIRPATING WEEDS.

As far as we are able to ascertain there is no law in this State requiring the destruction of any weed except the Canada Thistle and the Dagger Cockle-bur. There are, however, several plants that are becoming so troublesome in different parts of the State as to require united efforts for their destruction. We desire to call especial attention to these new weeds that are continually coming into the State and urge that they be destoyed before they become thoroughly established.

An act for the Extirpation of the Canada Thistle:

SECTION 1. It shall be the duty of the Supervisors of the several counties in this State, in addition to the duties hitherto prescribed by law, to cause the destruction, in the manner which to the said supervisor shall seem the most effective, of the weed known as the Canada thistle, where such weed shall be found growing upon the public highways and county roads of this State.

SEC. 2. The road supervisor of each road district in this State shall immediately after this Act takes effect, and from time to time thereafter, ascertain whether or not there is any weed known as the Canada thistle in his road district, and shall as soon as he ascertains that there is any of said weed, notify the county court of his county in writing at a regular session thereof of the existence of said weed, and upon whose land the said weed is growing. As soon as the county court has received said information said court shall appoint a householder in said road district as a commissioner, to hold office for the term of one year, whose duty it shall be to cause the said weed to be extirpated wherever found within said district.

SEC. 3. When the commissioner aforesaid is appointed it shall be his duty to ascertain from the road supervisor of his district the exact location of said weed, and he shall then notify the owner of the land upon which it is growing of its presence thereon, and request said owner to effectually remove said weed from his land; and in case the residence of the owner is unknown or is so far away that he cannot be notified, or, if notified, can not attend to the extirpation of said weed within a reasonable time, then it shall be the duty of the commissioner to notify the occupant of said land and request him to extirpate said weed from said land.

SEC. 4. If such owner or occupant shall fail or refuse to destroy such weed after being notified by the commissioner of the existence of such weed upon his land, then it shall be the duty of said commissioner, and he shall have authority to go upon said land and cause said weed to be extirpated from said land in the manner which to him seems the most effective, The expense of destroying said weed on said land shall be paid upon proper showing made by the commissioner out of the county funds, and shall be and remain a charge upon said lands, to be assessed to said land and collected the same as taxes: *provided*, that the same may be remitted by the county court at any regular session thereo upon the petition of ten resident householders of the precinct where said petitioner resides

Sec. 5. The commissioner shall receive from the county for his services, specified in sections 3 and 4 of this Act, the sum of two dollars per day actually employed.

Sec. 6. If the road supervisor or commissoner mentioned in this act willfully violates

any of the provisions thereof, he shall be deemed guilty of a misdemeanor, and upon conviction thereof in any justice's court having competent jurisdiction, shall be fined not less than fifty nor more than one hundred dollars for each offence.

Sec. 7. It shall be the duty of all municipal corporations and county authorities in this State to provide for the extermination of said Canada thistle within the limits of such corporation or on the vacant lands within such county, and any city or town corporation within this State neglecting or refusing to comply with the provisions of this section shall be liable to a forfeiture to the State of a sum not less than fifty nor more than five hundred dollars, to be recovered by suit in the name of the State in any court of competent jurisdiction.

Sec. 8. It shall be the duty of the several district attorneys of this State to prosecute all suits brought under the provisions of section 7 within their respective counties, and such attorneys shall be entitled to a fee of twenty-five dollars for every judgment renderd in favor of the State in such suits, and shall be entitled to a fee of ten dollars for every suit brought under the provisions of this Act when judgment is rendered against the State.

Sec. 9. Inasmuch as there is urgent need for the immediate extirpation of this weed, this Act shall take effect upon its approval by the Governor.

Session Laws of Oregon 1889, pp. 70-72.

An act for the Destruction of the Dagger Cockle-bur:

Sec. 4208. It shall be the duty of the supervisors of the several counties in this state in addition to the duties hitherto prescribed by law, to cause the destruction of in the manner which to said supervisors shall seem most effective, of the weed known as the dagger cockle-bur, where such weed shall be found growing upon the public highways and county roads of this state.

Sec. 4209. The road supervisor shall have the the power to warn out laborers upon the public highways for the extirpation of said weed, as in cases of repairs of such highways.

Sec. 4210. Any road supervisor neglecting to perform his duty under the provisions of this chapter shall be liable to a fine of not more than twenty-five nor less than five dollars, to be recovered to the use of the county before any justice of the peace by suit in the name of the county.

Sec. 4211. The owners or occupants of lands shall carefully extirpate such weed when the same is found growing upon the land of such owner or occupant; and if such owner or occupant shall fail or refuse to destroy such weed after being notified by the road supervisor or any other person of the existance of such weed upon his land, then it shall be the duty of the road supervisor to cause said weed to be destroyed upon said land, and at the expense of the owner thereof, the expense of such labor in destroying such weed to be recovered by suit in the name of the county before any court of competent jurisdiction.

Sec. 4212. It shall be the duty of municipal corporations and county authorities in this state to provide for the extermination of the said dagger cockle-bur within the limits of such corporation, or on the vacant lands within such county, and any city or town corporation within this state neglecting or refusing to comply with the provisions of this section shall be liable to a forfeiture to the state of a sum not less than fifty nor more than five hundred dollars, to be recovered by suit in the name of the state in any court of competent jurisdiction.

Sec. 4213. It shall be the duty of the several district attorneys of this state to prosecute all suits brought under the provisions of section 4212 within their respective counties, and such attorneys shall be entitled to a fee of twenty-five dollars for every judgment rendered in favor of the state in such suits, and shall be entitled to a fee of ten dollars for every suit brought under the provisions of this chapter when judgment is rendered against the state.

Chapter 82 Hill's Annotated laws of the State of Oregon.

It will be noticed by some that in the plants mentioned below the common or English name is followed by another printed in *italics*. This is the scientific or Latin name used by botanists the world over, while the common name changes even in different parts of the state. Thus in the above law one might be uncertain whether "Dagger Cockle-bur" means *Xanthium spinosum*, *L.*, *Gilia squarrosa*, H. & A., or some other plant. All uncertainty would be removed by the use of the Latin name.

CIRCULAR ON WEEDS.

In order to learn more about the most injurious Oregon plants we prepared and sent out two thousand circulars setting forth

briefly the damage annually caused by weedy plants and urging all to co-operate with us by answering the following questions:

Name.....Post Office,.....County,.....

1. What are the worst weeds growing upon your farm and roadsides? Name them in order of badness, beginning with the worst, and in case of doubt as to name or properties send specimens.
2. What is the character of the soil?
3. What means do you take to destroy your weed crop? Do you cut and burn them or do you compost them? With what result?
4. What weedy plants if any do you use for fodder and for what animals? Do you consider them of much value?
5. What new weeds have you noticed on your farm lately? Do they spread rapidly or do much damage?
6. What medicinal or poisonous plants grow on your farm? State some of their properties.
7. Underline all of the following weeds that now grow on your farm. Place a question mark after the name of any plant that you do not know.

Tarweed, *Madia glomerata*, Hk.
Wild Oats, *Avena fatua*, L.
Dog's Fennel or May-weed, *Anthemis Cotula*, DC.
Canada Thistle, *Cnicus arvensis*, Hoffm.
Chess or Cheat-grass, *Bromus secalinus*, L.
Common Brake or Fern, *Pteris aquilina*, L.
Field or Sheep Sorrel, *Rumex Acetosella*, L.,
Bull Thistle, *Cnicus lanceolatus*, Hoffm.
Ribgrass or Narrow-leaved Plantain, *Plantago lanceolata*, L.
Bluebottle, French Pink, Cornbloom, *Centaurea Cyanus*, L.
Ox-eye or White Daisy, *Chrysanthemum Leucanthemum*, L.
Moth Mullein, *Verbascum Blattaria*, L.
Pepper-weed, *Gilia squarrosa*, Hk. and Arn.
Burdock, *Arctium Lappa*, L.
Common Mullein, *Verbasum Thapsus*, L.
Wild Mustard, *Brassica campestris*, L.

We received replies from ninety farmers living in the different counties of the state; from the facts thus obtained and from personal observations we have selected the following plants as among the worst Oregon weeds. Scientific readers who desire technical description of these plants should consult Gray's Manual or Watson's Botany of California as the following being popular descriptions necessarily loose some of their scientific accuracy.

Larkspur. (*Delphinium, sp.*)

The Larkspurs are perennial herbs with palmately lobed leaves. Sepals five, very irregular, upper one produced below into a long spur. Petals four, irregular, the two upper ones spured at base. This plant, found in woods and damp pastures, has been thought to be poisonous to stock. Dr. P. H. Irish, formerly the Station chemist, experimented with the common blue larkspur (*D. exaltatum, Ait*). as follows:

"Two well developed, healthy yearling steers were bought for the experiments, which were to discover whether the plants under examination were injurious, and if so to note the symptoms developed. Twenty-four specimens of larkspur were taken, the tops chopped and mixed with an equal amount of clover grass fed to one, the roots prepared in a similar way, were fed to the other animal, in both cases without any apparent ill effect. As great a quantity of the plant was fed to each as cattle under ordinary



PLATE IV.—May-Weed, Dog's Fennel. (*Anthemis Cotula*, DC.)



PLATE XI.—Mullein. (*Verbascum Thapsus*, L.)

circumstances would be liable to obtain in the pasture. The larkspur used was mostly in full bloom and the individuals were chiefly good sized plants. White larkspur was next tried. Thirty plants, well developed, in full flower, were fed in a manner similar to that noted with the blue larkspur. No effect noted." (Bulletin No 3, Oregon Experiment Station, October, 1889, p. 25).

ACONITE, MONKSHOOD. (*Aconitum Fischeri.* Reich.)

A perennial herb whose general appearance is similar to that of the above. Leaves palmately cleft, the divisions broadly wedged-shaped and cut-toothed. Sepals five, irregular, the upper sepals being arched into a hood which conceals the spur-like blades of the upper pair of petals. Petals five, the three lower minute, the two upper on long claws. The terminal spikes of dark blue flowers make a handsome appearance. Very poisonous but fortunately quite rare in this state. The spindle-shaped root has been mistaken for Horse-radish (*Nasturtium*) with fatal results.

WILD MUSTARD, WILD TURNIP. (*Brassica campestris* L.)

Root annual or sometimes biennial. Stem round, smooth, much branched, two to four feet high. Lower leaves of a blue-ish-green color, pinnately divided and with a large terminal lobe; upper leaves lanceolate with a broad clasping, eared base. Flowers bright yellow, sepals and petals four, the latter about half an inch long, stamens six, two shorter than the others, anthers long. Pods roundish or somewhat four-sided, two inches or more long and one-sixth of an inch wide, on spreading pedicels, the stout beak about two-thirds of an inch long,

The mustard has escaped from cultivation, degenerated, and become a great nuisance in cultivated fields and waste places. It does much damage in grain fields by choking out the grain.

Where once established it is difficult to exterminate as the seeds retain their vitality for a long time. Sheep are said to like the foliage and by their close nibbling will soon kill the plants. Cutting when in bloom will also kill it and a few years of clean culture eradicates it.

WINTER CRESS, YELLOW ROCKET. (*Barbarea vulgaris*, R. Br.)

This plant grows in the moist rich soil of fields, and along roadsides, resembling the above somewhat in appearance. Root perennial. Smooth, erect, branching, one to three feet high. Lower leaves lyrate with a large rounded terminal lobe, and one

to five pairs of lateral lobes, upper leaves obovate more or less pinnatifid at base. Flowers yellow, petals a quarter inch long. Pods erect about an inch long, somewhat angled, and beaked with the rather slender style. It may be destroyed in same manner as the Mustard.

SHEPHERD'S PURSE. (*Capsella Bursa-pastoris*, Mœnch.)

A common low-branching annual, found in neglected ground along roadsides and in gardens where it grows to the height of a foot or more. Leaves pinnatifid, growing mainly from the base of the stem and spread flat on the ground, stem leaves lanceolate, arrow-shaped, sessile. Flowers very small, white, at first crowded near the ends of the branches, at length forming a long leafless raceme. Pods on slender stalks, purse-shaped or flat triangular, a quarter of an inch long, broadest above and notched at the apex producing a large number of seeds. Does not root deeply and is readily destroyed by frequent hoeing, or good cultivation which induces a vigorous growth of more useful plants.

ALFILARIA, PIN-GRASS. (*Erodium cicutarium*, L. Her.)

This is a valuable and nutritious forage plant belonging to the Geranium family, Root annual. Stems hairy, much branched, spreading, seldom more than two feet high. Leaves pinnately divided, three to five inches long, consisting of about six pairs of sessile leaflets with narrow, acute lobes, stipules acute. Flowers small, rose-colored, in a four to eight flowered umbel borne on a peduncle longer than the leaves and rising from their axils. Sepals and petals five, stamens ten. Styles twisting spirally in fruit, bearded inside. The juicy leaves and stems are said by Prof. Brewer to give an excellent flavor to milk and butter. [See Plate II.

POISON OAK. (*Rhus diversiloba*, T. & G.)

Poison Oak is an erect slender shrub very abundant in many parts of the state. It grows from three to eight feet high and sometimes becomes stouter climbing by rootlets. Leaflets ovate or elliptical about two inches long, the three lobes and the teeth obtuse. Flowers whitish, one-sixth of an inch long, in loose axillary, peduncled panicles. Fruit white, one-fourth of an inch in diameter, compressed.

The Poison Ivy (*R. Toxicodendron*, L.) resembles this but differs in its sharply toothed, acuminate leaflets, and nearly

sessile panicles which are more dense in fruit. Both species are poisonous, causing a severe cutaneous eruption accompanied by an intense smarting or itching.

SWEET OR TREE CLOVER. (*Melilotus alba*, L.)

An erect, annual, or biennial herb growing from two to four feet high. Leaves pinnately trifoliate; leaflets obovate, toothed and truncate, fragrant in drying. Flowers small, white, borne on slender pedicels in spike-like racemes. Pods ovoid, leathery and wrinkled. The seeds resemble those of Alfalfa with which it is sometimes planted. It has been recommended as a honey plant and for soiling, but it is seldom used as a forage plant as cattle do not eat it when they can get other food.

BUR-CLOVER. (*Medicago denticulata*, Willd.)

This is a smooth annual belonging like the above to the Bean Family (*Leguminosae*), which like its near relative Alfalfa (*M. sativa*, L.), is valuable as a forage plant. Stem prostrate or ascending; Leaves pinnately trifoliate, leaflets obcordate, toothed above. Flowers small, yellow, usually three to eight, in a small cluster. Pods compressed, spiral, strongly net-veined; the thin keeled margin armed with a double row of hooked prickles which adhere to the wool of sheep causing much damage. It fruits abundantly and the pods, which remain good until the winter rains, are eaten greedily by sheep and cattle.

WILD GOURD, BIG ROOT. (*Megarrhiza Oregona*, Torr.)

Stems elongated, climbing from large, spindle-shaped, perennial roots. Leaves cordate, five to seven lobed; tendrils two to five cleft. Flowers small, white, in early spring, monœcious the sterile in racemes, the fertile pedicelled and solitary growing from the same axis. Calyx bell-shaped, teeth very small. Corolla rotate, deeply five to seven lobed with papillose segments. The young fruit with soft spines, matured fruit unarmed; seeds an inch in diameter and half as thick. The most effective method of destroying Man-in-the-ground is to make a deep hole in the roots with a crowbar and fill it with coal oil which causes them to rot. Strong brine has been used in the same way but is not as effective.

The sunflower family (*Compositæ*) contains many weeds which we are compelled to omit for want of space. The general

rules for destroying weeds given on page 5 will prove effective, as will also the methods given for Canada thistle on page 14.

SPINY OR DAGGER COCKLE-BUR. (*Xanthium spinosum*, L.)

A coarse annual found in farm yards and in waste places along roadsides, etc. Stems, two to four feet high, much branched, bearing long slender yellow triple spines, an inch long and very sharp, at the base of the alternate lance-ovate leaves. The leaves are white-downy beneath and attenuate to both ends with a short petiole.

Heads monœcious, pistillate flowers enclosed in a bur-like, ovoid, closed, two-celled involucre armed all over with strongly hook-tipped prickles which cause great annoyance in the fleeces of sheep. Clean culture with a hoed crop, or seeding with clover, will with frequent mowing keep the plant subdued.

TARWEED. (*Madia sativa*, Mol. var. *congesta*, T. & G.)

A viscid, hirsute, glandular, heavy scented annual two to three feet high. Heads sessile, many flowered, in crowded clusters opening in early morning and in cloudy weather. Ray flowers five to twelve, disk flowers same number. Akenes, narrow, angled, smooth, and destitute of pappus. Leaves lanceolate, entire, the upper alternate. The whole plant is covered with a tar-like secretion which adheres to clothing etc., thus aiding in distributing the plant. This and the Dog's Fennel are a curse to western Oregon and their destruction should be required by law. We can give only general remedies such as underdraining which in "white land" has proven of much value in destroying this vile weed. Keeping the plants cut down and burning over the infested fields is also good. The seeds will stand a hot fire and often remain in the soil a long time before germinating.

A parasitic fungus (probably *Coleosporium Madiæ*, Cke., though it is not given in Farlow's Host. Index as occuring on this plant) was very abundant in the fall of 1891 and proved quite destructive. [See plate III.

MAY-WEED, DOG'S FENNEL. (*Anthemis Cotula*, DC.)

Root annual. Stem one to two feet high, erect and simple below or with spreading branches at the base. Leaves numerous, alternate, one or two inches long, twice or thrice pinnate, the fine segments giving them a feathery appearance. Heads radiate, terminating the long slender branches; disk yellow, globular ⅓



PLATE X.—Pepper-weed. (*Gilia squarrosa*, H. & A.)



PLATE VI.—Canada Thistle. (*Cnicus arvensis*, Hoffm.)

inch in diameter. Disk flowers fertile, the upper with chaffy bracts, ray flowers neutral, white.

This strong scented and bitter tasting weed is now naturalized in pastures and along roadsides, delighting in hard dry soils. This weed though one of the most abundant in the State may be readily destroyed by mowing, when it is coming into bloom, and burning the tops. If none are permitted to seed the land will soon be freed of this pest. [See plate IV.

WHITE-WEED, OX-EYE-DAISY. (*Chrysanthemum Leucanthemum* L.)

A few branched perennial, one to two feet high, stem sparingly covered with narrow coarsely-toothed, obovate leaves, the upper sessile with a clasping fringed base, the lower ones petioled.

The stem and branches are each terminated with a single head of flowers about an inch and a half in diameter. Within the thin scaled involucre are two kinds of flowers—an outer row of flat, showy, white ray florets and a central cluster of short, tubular, yellow disk flowers—both of which are fertile.

This though a native of Europe is widely spread over the United States, in some cases it has escaped from flower gardens, in others it was introduced in grass or clover seed. It spreads rapidly both by the creeping root-stocks and by the abundantly produced seed.

Its history in Benton Co., is as follows: In 1879 or 1880 Mrs. Fridley sent east for Margarite seed which she sowed in her garden. In three years the plant had run wild and become thoroughly established; it spread rapidly and the gain each year was four or five rods. It traveled toward the east and south faster than to the west and north because the prevailing winds are from the west and north.

If the land is kept fertile, seeding heavily with pure grass and clover seed will keep the daisies down so that the few remaining plants may be readily destroyed. The close grazing of sheep will soon exterminate it. In wheat land the summer fallow, plowing twice during the season is said to be effective. [See plate V.

CANADA THISTLE. (*Cnicus arvensis*, Hoffm.)

This plant differs from the common Bull Thistle (*C. lanceolatus*, Hoffm.,) for which it is often mistaken, in its slenderer stem and branches, in the thin, narrow, curled and more deeply cut leaves, less rigid prickles and smaller flower heads which are

about half an inch in diameter. It is more difficult to destroy than the common thistle as it is a perennial spreading by long underground stems, which penetrate deeply into the soil, often below the reach of the plow.

These rhizomes extend horizontally in all directions and being furnished with buds send branches to the surface where the first year radical leaves are developed and the second year aerial stems which bear flowers and seed. The second autumn these die down to the ground but in the spring the rhizomes again send up numerous branches which soon cover the ground, the plants spreading with suprising rapidity from year to year.

This "Cursed thistle" is also propagated by seeds which supported by the downy pappus are often carried long distances by the wind. Like most of our troublesome weeds it was introduced from Europe and has become permanently established in this country. It has been reported from the following localities in Oregon:

Benton County, Moses Craig, Corvallis.
Clackamas County, L. P. Williams, Oregon City.
Curry County, E. A. Thorhaven, Langlois.
Harney County, D. Overton, Drewsey.
Lane County, S. C. Sparks, Thurston.
Marion County, Eugene Brown, Silverton.
Sherman County, Isabel Reed, Moro.
Umatilla County, S. K. Coe, Milton.
Washington County, K. Sattler, Buxton.

EUGENE BROWN says: "It seems the thistle is very abundant in Marion county. The first start in this neighborhood was about twenty years ago when a man bought a new separator from the East. The spot on which the machine was set up and first run was found to have a number of fine Canada thistle plants the next year. A neighbor who had a number of patches on his place last season—supposed to have been bought in seed grain—tried my plan of salting them and exterminated about a quarter of an acre."

L. P. WILLIAMS says; "Canada thistle has been growing on this farm seven years, it has never been allowed to seed but has spread from the roots. Three years ago it occupied ten square feet now it is spread thinly over twenty square feet. After repeated trials to down it I pronounce it impossible unless each root is dug out carefully. I have had the best success in putting it back by letting it bloom, cutting it two inches under ground then salting and covering with dirt, under this treatment it did not show itself until late the next spring. I always bring every fragment of thistles cut to the house and burn in fireplace."

How to destroy Canada Thistles.

Frequent deep plowing will, in shallow dry soils nearly always destroy the thistle but in light, rich, moist soils this usually fails. Wherever a dense sod can be formed seeding will be found the easiest means of destruction; though not so rapid as plowing,

hoeing, salting, or burning where these means are available. On rich bottom lands or in ground filled with stumps, a grass sod will be found the best destroyer. If the land is not rich enough to form a good sod manure it. Mowing when the thistle is *coming into* bloom does not destroy the plant though it checks its growth. Applying kerosene oil to the roots after cutting is effectual and practicable in small patches. In stony ground the scythe, salt, and sheep will be found good destroying agents. If the thistles are in fence-rows move the fence and plow. One object of thorough cultivation is that all thistle seeds may germinate and be destroyed at once and not lie dormant in the ground coming up a few at a time to reseed the field.

The seeds resist everything but a hot fire, and Dr. Millspaugh says: "The larger the fire, the better, it would be more profitable to use a barn or two for fuel than to allow this weed to grow and mature seed." *Caution.* Plowing and stirring the soil when infested with this weed, unless thoroughly done, only multiplies them, so permit no leaves or roots to remain and burn the plant immediately after cutting. [See plate VI.

COMMON OR BULL THISTLE. (*Cnicus lanceolatus*, Hoffm.)

This is a biennial, producing the first year simply a tuft of large spiny leaves spread out flat upon the ground but the second year it sends up a stout, erect branched stalk two to four feet high. The pinnatifid leaves are about five inches long and the lobes are provided with sharp, stiff spines. It may be distinguished from the Canada thistle by the larger flower heads, one to one and a half inches in diameter, and the sessile leaves cobwebby beneath with margins running down the stem as ragged wings. This objectionable weed, which delights in a rich soil, is common in pastures and along roadsides. It should be carefully destroyed as the seeds supported by the spreading pappus are carried long distances through the air scattering the plant far and wide. The Bull Thistle is easily killed by keeping it cut just below the surface of the ground as the plant is sure to soon die of exhaustion. Any of the methods suggested for exterminating the Canada thistle will destroy this. [See plate VII.

BURDOCK. (*Arctium Lappa*, L.)

This is a coarse, large leaved, biennial found in waste places and in rich soil about dwellings. It has a thick branching stem

two to four feet high, with heart shaped leaves, the lowest on long stout petioles, the upper nearly sessile. Flower heads nearly round, about an inch thick and of a purple color, occuring in small clusters at the ends of the branches. The floral scales are abruptly tipped with an awl shaped hook by which the "burs" adhere to the wool of sheep or the hair of cattle.

It is easily destroyed by cutting off the root a few inches below the surface of the ground, or by mowing when in bloom and burning the tops. [See plate VIII.

FRENCH PINK, STAR-THISTLE. (*Centaurea Cyanus*, L.)

Stem branched two to four feet high. Leaves alternate, lance-linear, sessile, entire. Heads large, solitary, many-flowered; the neutral marginal florets blue, enlarged and conspicuous, the central ones purple, perfect. Scales of the globular involucre fringe margined. Pappus shorter than the oblong compressed akene.

A troublesome weed in grain fields becoming common in Western Oregon. As it is an annual it may be destroyed by keeping it cut and not permitting it to ripen seed.

SOW-THISTLE. (*Sonchus oleracea*, L.)

A smooth, leafy-stemmed annual, two to three feet high, of coarse appearance, with paniculate, many-flowered heads of yellow flowers. Leaves runcinate-pinnatifid, with short, soft. spiny teeth clasping by a heart-shaped base. Involucre thickened at base, scales imbricated. Pappus of copious white cappillary bristles, united at base. Akenes compressed, scabrous, many ribbed but not beaked. Waste ground and in gardens, easily destroyed by cultivation. [See Plate IX.

PEPPER-WEED, SKUNK-WEED. (*Gilia squarrosa*, H. & A.)

A rigid, stout, much branched annual, very glandular and pungent, smelling like its namesake and causing a flow of tears when broken by threshing. Leaves twice pinnatifid, the upper bracts spinescent. Corolla blue, slender, tubular, half an inch long, shorter than the entire calyx lobes. Abundant everywhere. Keep it cut down. [See Plate X.

DODDER ON ALFALFA.

This Dodder (*Cuscuta racemosa*, Mart. var. *Chiliana* Eng.) is parasitic on Alfalfa or Lucerne (*Medicago sativa*, L.) The Dodders are leafless annual herbs with thread-like yellowish stems rising from the ground and becoming parasitic on the bark of



PLATE XX.—Brake. (*Pteris aquilina*, L.)



PLATE XVII.—Wild Oats. (*Avena fatua*, L.)

herbs and shrubs around which they twine and to which they adhere by means of suckers through which they draw juices from the host plant. The lower part of the stem then dies, but the threads develop rapidly until a circular patch of Alfalfa is covered by the Dodder and becomes so weakened that it turns brown and dies.

REMEDIES: *First*, plant only pure seed, dodder seeds are similar to those of Alfalfa but can be separated by careful screening. *Second*, if the meadow is but slightly infested, mow and destroy the infested patches as soon as seen, and if no patches are allowed to seed the Alfalfa will be saved. If, however, the meadow is full of dodder plow up the Alfalfa and plant other crops for a few years when all the Dodder seeds will have germinated and died for want of a suitable host on which to feed. *Third*, never save an infested crop for seed.

MULLEIN. (*Verbascum Thapsus*, L.)

A tall, woolly, biennial herb with alternate, decurrent leaves. Stems erect, unbranched, three to six feet high. Leaves oval-lanceolate, entire, six to twelve inches long. Flowers bracteate, bright yellow, in dense terminal cylindrical spikes. Plate XI shows a specimen collected by the author in Benton county.

The Moth Mullein (*V. Blattaria*, L.) differs from the above in the smooth, slender stem and serrate not decurrent leaves. Lower leaves petiolate often pinnatifid, the upper sessile clasping. Flowers white or yellow in a long raceme, pedicels about an inch long. Filaments bearded. Both these plants produce a vast number of seeds and should be carefully destroyed by digging up the roots when young.

NARROW-LEAVED OR ENGLISH PLANTAIN. (*Plantago lanceolata* L.)

A stemless perennial, with hairy, stongly ribbed leaves four to eight inches long and tapering towards both ends. Scapes several, one to two feet high, spike one to two inches long, nearly cylindric, dense-flowered. Seeds oblong, convex on one side concave on the other, shining, brown or amber-colored.

This plant, though a native of Europe, is now found throughout the entire country in pastures, meadows and lawns. Some consider it a good forage plant for sheep and cattle. The seed is easily distinguished from that of grasses and other forage plants, which should be carefully examined before planting. If the weed is once established, plow it under and cultivate the soil for a few

years. Small patches may be destroyed by cutting off the plant a few inches below the surface of the ground with a sharp hoe. A heavy crop of clover or grass would perhaps choke it down. [See plate XII.

YELLOW OR CURLED DOCK. (*Rumex crispus*, L.)

Coarse perennial herbs with an acid juice. Stems smooth, two to four feet high, from a fusiform root. Leaves narrowly lanceolate, acuminate, wavy-curled, about six inches long on short petioles. Panicles open with numerous dense whorls of small green perfect flowers. Akenes a line long, three angled, wingless. It is best destroyed by pulling up the roots when the ground is wet. [See Plate XIII.

FIELD OR SHEEP SORREL, RED TOP. (*Rumex Acetosella*, L.)

Sheep sorrel is a dicœcious plant which spreads rapidly by perennial running rootstocks. The stems are about a foot high, slender, erect and somewhat angular. Foliage very acid, but pleasant to the taste. Lower leaves are arrow-shaped and long staked, upper ones sessile. Flowers small in red or purplish racemes. Fruit three angled, wingless. As it grows most abundantly on poor thin soils, improving the land by the application of time and fertilizers is the best method of expelling it and with good cultivation the growth of other plants will soon crowd it out. It may also be subdued by keeping the infested land plowed for a short time. [See plate XIV.

PIGWEED, CARLESS WEED. (*Amarantus retroflexus*, L.)

A stout, erect annual two to four feet high with dull green, ovate, acuminate, long petioled, alternate leaves. Flowers minute, green, in thick, erect, scarcely spreading crowded terminal spikes. Bracts lanceolate, pointed, twice the length of the calyx. Grows in waste places and in gardens as does the following, pulling them up when young is easy and effective. [See plate XV.

PIGWEED, LAMB'S QUARTERS. (*Chenopodium album*, L.)

Root annual. Stem erect, branched, striate, two to four feet high. Leaves, rhombic-ovate, one to three inches long; lower dentate, upper lanceolate. Panicle strict or somewhat spreading. Flowers apetalous, densely clustered in close spikes. Whole plant mealy. [See plate XVI.

WILD OATS. (*Avena fatua*, L.)

This is supposed, by some, to be the original of the cultivated

oat (*A. sativa*, L.) which it closely resembles and which is said to readily degenerate into this. Though an annual it will effectually run out any crop and take entire possession of the soil. It ripens early and shells easily, the kernel when ripe is nearly black and attaches itself to clothing, grain bags, etc. The cleaned grain weighs from twelve to eighteen pounds per bushel and is sometimes ground as a food for stock. The lower palet [chaff] is rough and covered with long brownish hairs. The long, rigid, bent awn is very sensitive to changes of moisture and by its twisting readily burys the seed in damp soil. The wild oat is very abundant in fields all over the state and is sometimes sown for fodder; it is said to make a fair quality of hay for horses and cattle if cut early. Sow only pure seed.

Plow the soil well in the spring making a good seed bed which will induce an early crop of wild oats, when they are four or five inches high plow under and repeat this process of turning under, pasturing with sheep or pulverizing with a spring tooth harrow as long as the plants come up; thus the seeds already in the soil will germinate in one or two seasons instead of coming up a few at a time; if the work is carefully done and no plants permitted to produce seed the ground will be free in a few years. This is a tedious process but there is no royal way to kill the wild oat, unless it be seeding down the land for three or four years. [See plate XVII.

J. P. Taylor of Cottage Grove, Lane Co., says: "I have tried mowing, raking up and hauling wild oats off the land with good results; turning in sheep to eat the missed stalks and heads before they get dry and to keep the after growth from going to seed. The ground is as effectually cleaned as by fallow plowing but can not be put in as early in the fall."

Chess or Cheat. (*Bromus secalinus*, L.)

Chess is a coarse annual grass, with large spikelets, which when properly cured makes excellent hay and large quantities are annually saved for this purpose in some parts of the state. Culm or straw three to four feet high. Leaves six to twelve inches long, narrow, earless, rough and hairy on upper surface, sheath entire. Panicle spreading, spikelets oblong-ovate, turgid, smooth. Glume longer than the palet, short awned. This plant has occasioned considerable discussion because under certain conditions a large amount of cheat appears in wheat fields where there has been none for a long time previous, causing the idea that the wheat had turned to chess, which is not so. Sow only pure seed and keep the grass cut. [See plate XVIII.

COUCH, QUICK OR QUACK GRASS. (*Agropyrum repens*, L.)

A perennial grass with white, jointed, creeping, underground stems which interweave forming a stiff sod. Culm two feet high, smooth. Leaves rough, four to ten inches long, flat and narrow. Spikelets four to eight flowered, awn shorter than the flower. Very troublesome in cultivated ground because of the vitality of the rhizomes and seeds. The best remedy is to dig or plow up the rhizomes and burn or feed them to cattle. [See plate XIX.

COMMON BRAKE OR FERN. (*Pteris aquilina*, L.)

Rootstock blackish, cord-like, creeping widely underground. Frond dull green, two to three feet wide, three-branched at the summit of an erect, stout stalk one to four feet high. Abundant all over the state forming thickets four to seven feet high and several acres in extent. Stipes not articulated to the rootstock. Branches of the frond widely spreading, twice pinnate ; pinnules oblong lanceolate; the upper undivided, the lower pinnatifid with obtuse lobes. Spores in a continuous slender line occupying the entire margin of the fertile frond and covered by its reflexed edge. There are two forms known as the Big Fern and the Little Fern, the former attains a large size in the foot-hills while the latter grows in the valleys, where it causes much damage by crowding out the crops. Some have recommended cutting it for hay but the dust-like spores are apt to cause indigestion and symptoms in horses similar to those of "Blind-Staggers." Good thorough plowing and the spring-tooth harrow will soon destroy it. [See plate XX.

ACKNOWLEDGMENTS.

In preparing this bulletin we had to depend in a great measure upon our correspondents for information and we take this opportunity to thank those who have aided the Station by sending specimens of plants growing in their vicinity and answering questions regarding their flora. It is through such friendly co-operation in Station work that the best results can be accomplished, as it is impossible for the Botanist to individually visit all portions of the State and make a study of the noxious weeds, forestry, injurious fungi, etc., without neglecting his classes at the College. When you find a weed or fungus that is liable to become injurious, or a plant that may prove valuable for forage, write to the Station about it and we will help you all we can.

For much of the information in this bulletin we are indebted to the Manuals of Botany, to Darlington's American Weeds, to

our circulars, and to the Bulletins of various Experiment Stations. We have selected and placed in an accessible form as much as our limited space permitted of what is now known regarding Oregon weeds. All the work was done during the rainy season on an unfamiliar flora, which accounts for the absence of many weedy plants, some of which, may appear in a future bulletin.

I desire to express my obligations to E. F. Pernot, of our Department of Photo-engraving, who has spared no effort to make the half-tone engravings perfect under existing conditions. Our thanks are due to Dr. Geo. Vasey, Botanist of the Department of Agriculture for assistance in procuring the electro-types used in this bulletin and to Geo. Marx, chief of Division of Illustrations, for making them.

How to send Plants for Identification.

Remember that the Station was established for your benefit and if at any time you desire information concerning plants growing on your farm, or along the roadsides, or about any plant disease, we will be glad to answer your questions as fully as possible. Questions about plants should be accompanied by specimens, so we may know just what plant is meant. Fragmentary or imperfect specimens are so often sent to botanists for identification that it is necessary to state here what is needed to correctly determine a plant.

The specimens should be complete, that is, they should include the flowers, fruit, leaves and if herbaceous a portion of the root; often the root-leaves are different from the stem-leaves, so both should be sent. Of woody plants a shoot six or eight inches long bearing leaves and flowers and accompanied by the fruit, if possible, will be sufficient. Specimens may be preserved by placing them under pressure between sheets of newspaper immediately after gathering, changing the papers every day for four or five days, after which they will keep indefinitely. All specimens should represent the typical form except when the object is to show some abnormal growth. Number the specimens, wrapping each species separately in old newspapers, and send in an unsealed package with your name and address, preceeded by the word from, plainly written on the outside. The postage is one cent an ounce which must be fully prepaid or the package will not be forwarded. In the accompaning letter state the date and place of collection and whether the plant is considered medicinal, poisonous or weedy, with any other information you consider of interest.

Address all communications relating to plants to

BOTANIST, EXPERIMENT STATION,
Corvallis, Oregon.

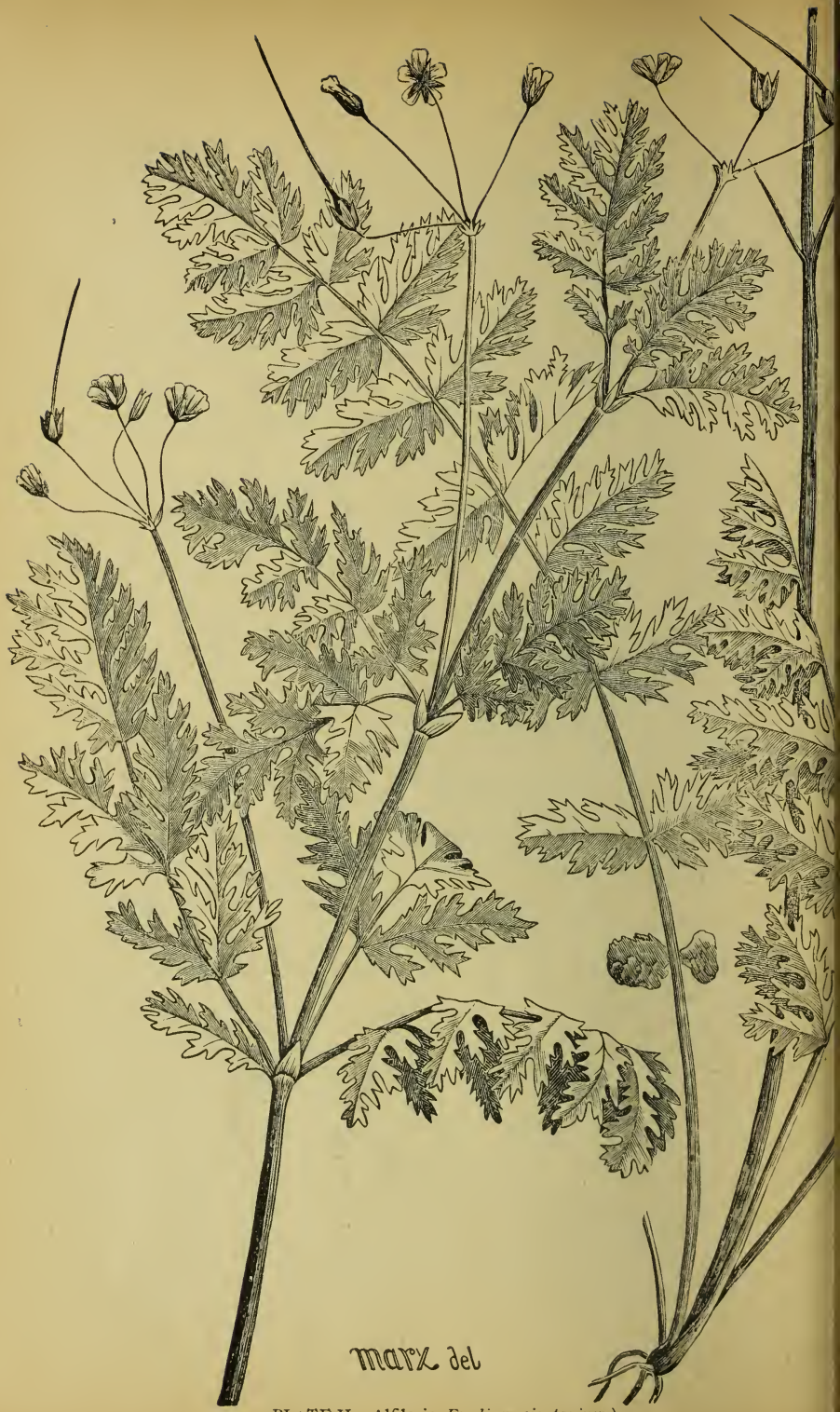


PLATE II. — Alfalaria *Erodium cicutarium*.)



PLATE V,—White-weed. (*Chrysanthemum Leucanthemum.*)



PLATE VII.—Bull Thistle. (*Cnicus lanceolatus.*)



PLATE VIII.—Burdock, (*Actium_Lappa*,)



PLATE XII.—English Plantain. (*Plantago lanceolata.*)



PLATE XIII.—Yellow or Curled Dock. (*Rumex crispus.*)



PLATE XIV.—Sheep's Sorrel. (*Rumex Acetosella.*)



PLATE XV.—Pigweed, (*Amarantus retroflexus.*)



PLATE XVI.—Pigweed. (*Chenopodium album.*)



PLATE XVIII.—Chess. (*Bromus secalinus.*)

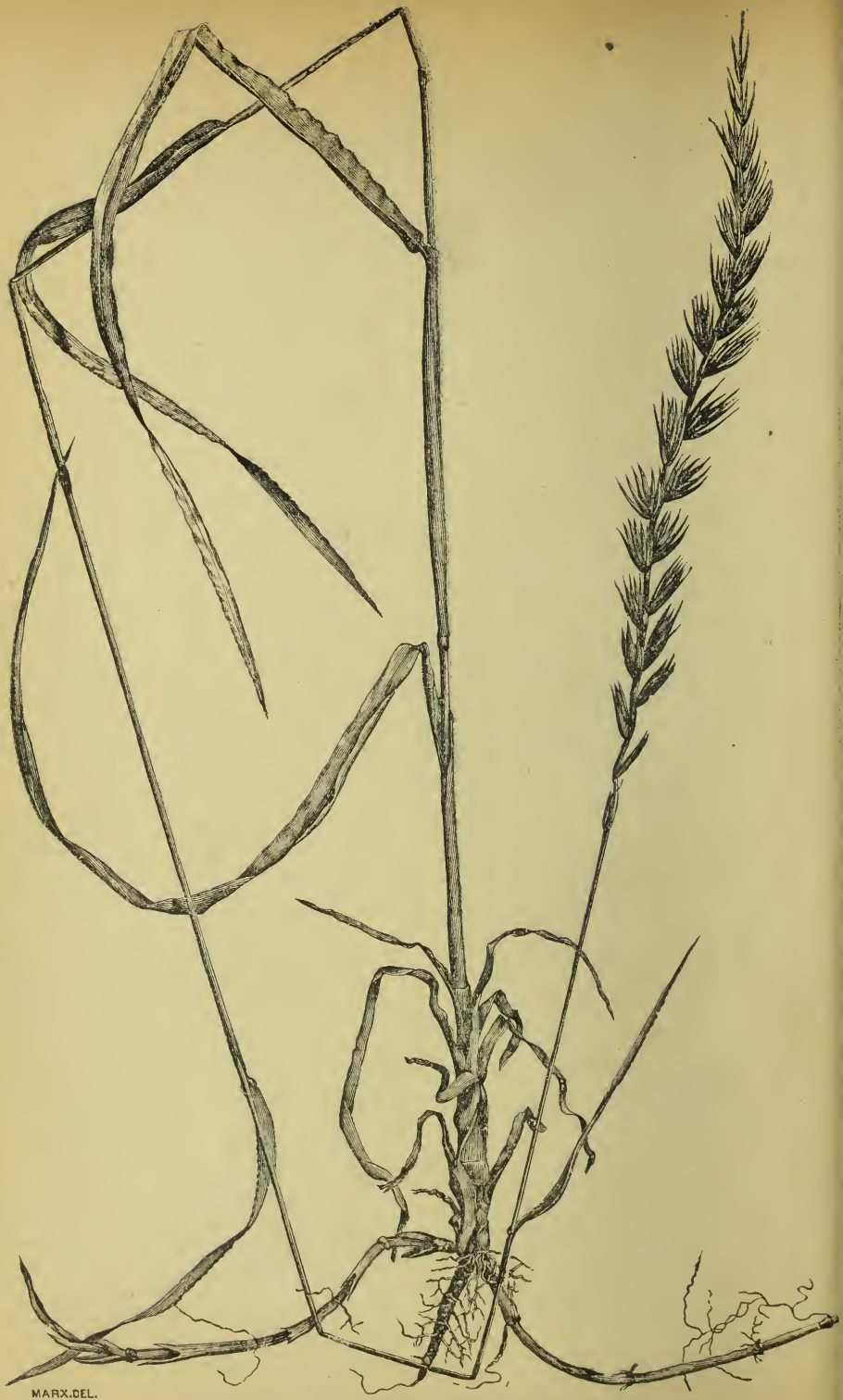


PLATE XIX.—Couch or Quack-Grass (*Agropyrum repens.*)

Oregon Agricultural Experiment Station.

Bulletin No. 20. September, 1892.

AGRICULTURE.

Experiments in Pig Feeding.

H. T. FRENCH,
Agriculturist.

C. D. THOMPSON,
Foreman of Farm.

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

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CORVALLIS, OREGON:
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DUMONT LOTZ, M. Sc., A. C., ...*Assistant Chemist.*

REPORT ON EXPERIMENTS IN

PIG FEEDING.

Lot 1. Ground Oats and Wheat fed separately.
Lot 2. Whole Oats and Wheat fed separately.
Lot 3. Mixture ground Oats, Wheat, Barley, and Shorts.

Object of the Experiment.

The work detailed in this Bulletin was undertaken with the view of throwing some light upon the methods of feeding pigs in Oregon, and at the same time encourage, if possible, more thorough work in this branch of farming.

Before undertaking the work, a printed circular was sen individuals in various parts of the State, making inquiry as to the methods now in practice along this line. A copy of this cir-

cular is printed in this report, also a summary of the replies received. There were seventy-five circulars sent out, and sixty came back, carefully filled out as requested. The replies cover every part of the State, so that we might fairly consider them as representative of the methods generally practiced throughout the State. We do not mean to say that there are not individuals, and possibly neighborhoods, where better methods are followed, than these replies would indicate; but from our own observation, and from personal inquiry, we are led to believe, that the existing conditions are very truly reported, and would indicate the actual circumstances surrounding this industry, in the State. It is not with a view of being unduly critical, of the methods already in practice in this State, that we undertake the work, but with an honest desire of assisting in building up this neglected, and little thought of, branch of farming.

People coming here from the east, find the conditions quite different from those surrounding the industry, in the states from which they came. Corn, the great pork producing food of the middle west, cannot enter into the problem of pig feeding, throughout a greater portion of the State of Oregon. To demonstrate to those who are doubtful of the success of feeding pigs, without the aid of this highly carbonaceous food, the practicability of such work, is one of the chief aims in this experiment. That we have not reached a definite conclusion is fully realized; yet some points have been established which are very encouraging to those who wish to make pig feeding, in Oregon, one of the important factors of the farm.

Nearly 40 per cent. of the replies to the circular sent out were to the effect that where grain, such as wheat, barley and oats, entered into the list of fattening foods, they were fed separately and unground.

This raised another question in our minds, whether there was not a great loss from the lack of a proper combination of food materials, and from feeding the grain in a whole condition. We are confident there is a loss from the latter practice, and no doubt better results can be obtained, where the food materials are combined so as to induce more thorough assimilation. This

feature of the work we purpose to follow still further during the present season.

Another problem confronts us, when we see that 50 per cent. of the replies to the letter of inquiry, show that pigs are slaughtered after they have passed one year of age, and 25 per cent. show that pigs are not slaughtered, until one and one-half years is passed. That there is a loss in growing the pig and then fattening him at one to one and a half years of age, is conceded by all. The pig should be crowded from birth to maturity, which, in case of any of the improved breeds, should not exceed twelve months, and the best results will be realized below this age. That this can be done in Oregon, as well as in Kansas or Iowa, or any other eastern state, we are confident. It is not so much a matter of breed in early maturity, as it is the feed and care given the animals. Proper breeding goes a long ways towards success, and without it we cannot hope to succeed in swine husbandry ; yet the best of breeding counts for naught, unless followed by intelligent feeding.

A few reports came in, to the effect that pigs of some of the improved breeds, have been made to weigh three hundred pounds at eight months of age; and these men think that raising pigs for market in Oregon, pays a good profit. That raising hogs, and feeding them for market on a large scale, as in the great corn states, in connection with cattle feeding, we are well aware cannot be done ; but on the other hand, where a few men succeed in producing pork at a profit, there is room for many more to enter into this work before our markets are stocked with Oregon products. Immense quantities of pork products are shipped into this State every year from the east, and it is our purpose to stimulate, if possible, the desire to meet this demand from the farms of Oregon.

In the matter of cost the results are not wholly satisfactory, yet the comparisons are just as valuable in determining better methods of preparing foods. In table II it will be seen that the cost of producing a pound of pork, by feeding ground material, was considerable less than by feeding whole grain ; and the cost is still further reduced by mixing foods. In mixing, we are enabled to use less of the high priced food, and more of the lower

priced materials. In case of the mixed food, there is a saving of nearly 24 per cent., and 18 per cent. in favor of the chopped grain over the whole grain.

In the cost of materials given in this table, it will be observed that wheat is quoted at 82 cents per bushel, the price when the feeding was done. This is above the average price for wheat during the past three years. The ruling price this season has been from 60-65 cents in the Willamette valley.

Barley is a most valuable grain for feeding purposes, and comes nearer corn in point of its fattening value, than any other grain unless it is wheat.

In the actual production of pork on the farms of Oregon, many other valuable materials might be brought into use. Among these we would mention peas, green corn, clover and green vetches for pasture, and artichokes are also grown in some sections with more or less success. We are testing these at the Experiment Station, at the present time, the results of which will be published in a future Bulletin.

CONDITIONS OF THE EXPERIMENT.

In order to carry on the work in hand, a brood of eight Berkshire pigs was purchased at four weeks of age. The sow was purchased with the brood, with the intention of allowing her to suckle the pigs until they were six or eight weeks old. In delivering the pigs at the College farm, the sow was injured so that the pigs had to be weaned, thus depriving them of nature's assistance at a comparatively early age. This, no doubt, checked the most rapid growth of the pigs, thus lessening their development to some extent.

The pigs were born March 19th, making them ten months and ten days old when slaughtered. From the time the pigs were weaned, until September 1st, when the feeding experiment began, they were given slops from the kitchen, with shorts added in sufficient quantity to keep the pigs in a vigorous, growing condition. The pigs had access to a small yard attached to the pen, but no green food was given them. Grass, and plenty of exercise, are the most important features connected with raising swine; but this should be supplemented with sufficient grain to keep the pigs growing to their fullest capacity. There

is no pasture equal to a good clover pasture, for growing swine, but this is not common in Oregon, at present, hence, it becomes almost a necessity, in crowding pigs to their utmost, to feed them grain. I know of nothing better for young pigs, than shorts or fine middlings.

September 1st six pigs were selected from the pen for the feeding experiment. There were three sows and three barrows in the lot. These were weighed and placed in three pens, a sow and a barrow in each pen. The pigs we selected so that the total live weight of each lot would be as nearly equal as possible. In this we were fairly successful, as will be seen in table I. The pigs were a very uniform lot and fine specimens of the breed.

The feeding began September 1st and ended December 29th, making 120 days. The hours for feeding were 8 A. M. and 5 P. M. Much stress was placed upon the matter of feeding, at the exact time. There is no stock that appreciates this more than swine. The pigs became so accustomed to the time that they would make no stir until the proper time for feeding came. Should the time be put off for ten or fifteen minutes, the pigs would make their wants known very loudly. Charcoal was given the pigs two or three times a week, throughout the feeding period. There was scarcely no time during the feeding, that the pigs would not leave their regular feed for the charcoal, which they seem to enjoy grinding as the eastern porker would grind kernels of corn.

KIND OF FOOD AND THE MANNER OF PREPARATION.

As was hinted in the beginning, an effort was made to use such food, as could be obtained on the farms of Oregon. Pen No. 1 was fed during the first two months on chopped oats, exclusively. In this, and each of the other pens, the grain was mixed with enough water to soak it up thoroughly, and allowed to stand until the next feeding hour. Salt was sprinkled in each ration, as it was weighed out for the succeeding feed. October 30th, ground wheat was substituted for ground oats, and fed in the same manner, until the end of the experiment.

Pen No. 2 was fed whole oats for two, months and whole wheat the remainder of the time.

Pen No. 3 was fed a mixture of grain made up as follows: From September 1st to October 30th, two months, ground oats, wheat and shorts were fed in equal proportions by weight

October 30th. Barley was substituted for shorts, and fed during November. At the end of November, shorts was again placed in the ration, making it one-fourth each of ground wheat, oats, barley and shorts. This was continued till the close of the experiment.

The pigs fed on the mixture were more contented with their fare, than those in either of the other pens. There was less food left in the trough in this pen, than there was in the others. Lot 1 and 2 would frequently get off their feed so that the amount would have to be cut down for a few days. Then, at other times they would eat all the food and yet be unsatisfied.

The pigs were given all the water they would drink, but there was no appreciable difference, in the amount required by the varions pens.

The manure was gathered at various times and examined, in a mechanical way, to determine how much of the whole grain passed through the digestive system, without being materially changed. As much as 50 per cent. by weight, of the entire dry excrement, from pigs fed on whole oats and wheat, was washed out at different times. The grain was passed in as perfect a condition as when fed, as far as the eye could detect. The same was true of those fed on the ground grain, where it was unmixed, except the material was finer. A large portion was, to all appearances, wholly undigested.

Oats, either chopped or whole are not relished as much as wheat, in a similar condition. It will be observed in table II that very slight gains were made by lot 1, while eating chopped oats alone. The same is largely true of lot 1, which was fed whole oats during the same period. We would discourage as much as possible, the feeding of oats to swine, unless mixed with some finer food, such as ground wheat, barley or shorts. Oats are excellent fattening food, when properly combined with other materials.

The pigs were slaughtered on December 30th, after sixteen hours without food. The weight of the various parts were taken, as shown in table III. There was no striking differences in the conditions of the vital organs, as regards size or appearance. In No. 3 of lot 2 there was a marked falling off in the amount of fat from the intestines, and a corresponding increase in the

weight of the intestines after the fat was removed. The per cent- of shrinkage is not very large, as compared with pigs of similar weight fattened on corn. There is only 14 per cent. difference between the average shrinkage of these pigs and a lot fattened on corn exclusively, at the Kansas agricultural college, under the direction of Prof. E. M. Shelton. In table III containing a summary of the results, I have given some figures taken from the report of the above experiment. These figures show an increase in the average daily amount of food consumed, and in the amount of food to make a pound of gain; also, increase in the average daily gains, over the pigs fed in this experiment. In the gain per cent. of live weight, lot 1 is above the corn fed pigs, and lot 3 is nearly up to them. In the Kansas corn fed pigs, the pigs were older and larger than those in our experiment, hence, we would naturally expect a larger amount of food consumed. The larger gains might be accounted for, in that the corn fed pigs were in a thinner condition to start with, hence, the gains would be larger at the outset.

OBSERVATIONS ON CUTS.

Upon examining the photo-engravings, it will be seen that there is some difference in the relative amount of lean and fat in the various lots. Whether this is due to the individual characterics of the pigs, or to the feed, we will leave for our readers to judge. Cuts 1 and 2 show photographic reproductions of the meat from lot 3, or the mixed fed lot. The meat was photographed by the Station artist on the day following the slaughtering. The cuts were made through the loin and between the six and seven ribs. It will be noticed that there is a large per cent. of lean meat in these samples. Thought to be a larger per cent. than in either of the others, by all who examined the meat at the time of slaughtering.

The texture of the meat in this lot was all that could be desired. The lean meat was of a little darker colored than that of lot 1 or 2.

Cuts 3 and 4 show similar sections of lot 2, or those fed on whole grain. There is a little larger per cent. of fat in this lot, and the meat was not quite as firm in texture as that of lot 3.

Cuts 5 and 6 are from lot 1, or those fed on the chopped grain, unmixed. These samples show the thickest fat outside of

the lean, and the lean is the lightest in color. Some of this meat was sold to a leading butcher in the city, and he made the remark, that the lean meat was the lightest in color of any he had ever cut up. He compared it to the white meat of a chicken. In texture the meat was not as firm as that of lot 3.

Cuts Nos. 3 and 7 are copied from photographs of Kansas pork. They were from pork fattened at the Kansas Agricultural College, under the direction of Prof. E. M. Shelton.

Through the kindness of the Kansas Experiment Station authorities, we are enabled to present these cuts, made from photographs, by Prof. E. Pernot of our own Station.

No. 7 is the one to which we wish to call special attention. This represents similar cuts to those in our own experiment from a pig of similar weight, fed exclusively on corn. The pork does not differ materially in appearance except in the amount of fat in the loin cut, in which particular, there is considerable more in the corn fed pork, than in those of our own experiment. No. 3 is a sample of the shorts-bram fed lot, from the Kansas station, and has no particular interest in connection with our experiment. It could not well be excluded in making the cut hence its appearance in connection with No. 7.

I wish to acknowledge the faithful work of Mr. C. D. Thompson, who cared for the pigs during the feeding experiment.

H. T. FRENCH.

Summary of Answers to Circulars sent out.

The following questions were asked as a preliminary work in contemplated experiments in this important branch of agriculture. Answers were given covering the immediate vicinity as well as individual work in this line.

1.—At what age are pigs usually fattened? Twenty-five per cent. under 1 year; 50 per cent. 1 year and under 1½ years; 25 per cent. over 1½ years and under 2 years.

2.—What breeds are most common? Berkshire, Poland China, grades from these breeds and "scrubs" in the order named.

3.—Are the breeds kept pure to any extent? Breeds are not kept pure generally.

4.—What is the most common food for growing pigs? Pasture on green wheat or woodland pasture. Pasturing on stubble is a common practice.

5.—What is the most common food for fattening pigs? Wheat, oats,

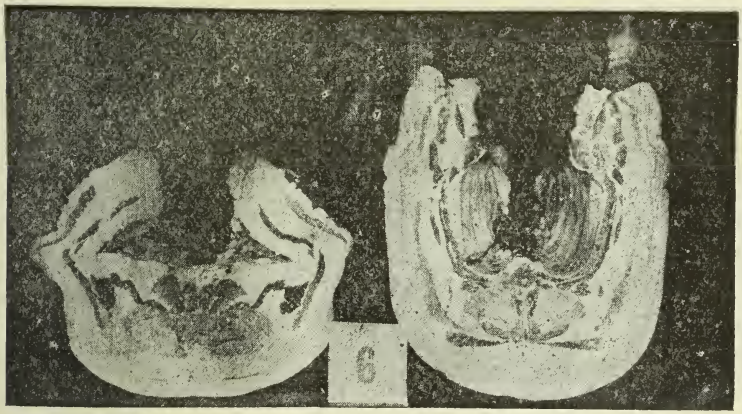

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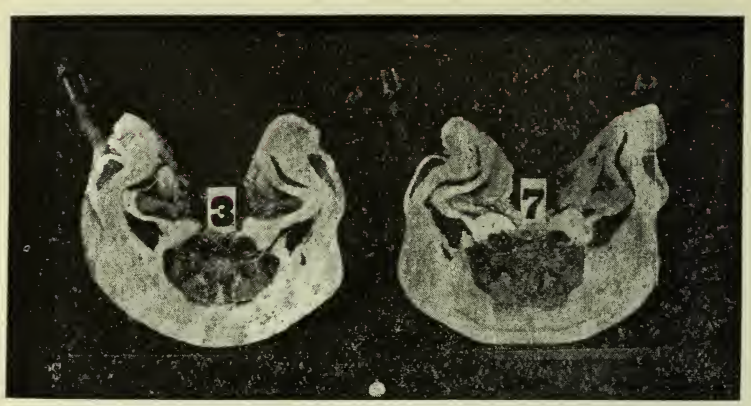

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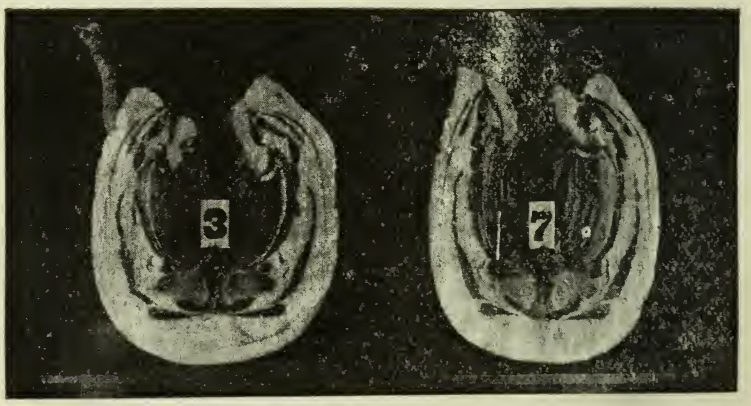

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4


5


6


3
7


3
7

barley and screenings in order named. Potatoes are cooked and fed in same localities.

6.—Is the grain ground or fed whole? Fifty per cent. report that grain is fed whole, while remainder use more or less ground material.

7.—Are foods mixed or fed separately? Fifty per cent. feed grain separately; remainder mix grains or feed in connection with potatoes or other vegetables.

8.—Are foods cooked to any extent? Only 8½ per cent. report that food is cooked, and that in case of vegetables.

9.—Average weight of pigs when slaughtered? Sixty per cent. report 150-200 pounds; 30 per cent. report 200-250 pounds, and 10 per cent. report 250-300 pounds.

TABLE I

Showing amount of gain by periods of two weeks, total gain, total weight, gain per hundred of live weight and average gain per hundred.

	Chopped Oats & Wheat.		Totals.	Whole Oats & Wheat.		Totals.	Mixture Chopped Oats, Wheat, Barley and Shouts.		Totals.
Dates of Weighing.	(1)	(2)		(1)	(2)		(1)	(2)	
September 1st	145	157	302	168	148	316	152	149	301
Gain September 15th	10	1	11	12	10	22	18	17½	35½
Gain September 30th	18	18	36	14½	18	32½	25	21½	46½
Gain October 15th	14	13	27	19½	17	36½	25½	24½	50
Gain October 30th	14½	19½	34	20½	17½	38	34	24½	58½
Gain November 14th	33	34½	67½	14½	27½	42	18½	15	33½
Gain November 29th	33½	35½	69	31	29½	60½	18½	16½	35
Gain December 14th	28	38½	66½	26	21½	47½	22	11½	33½
Gain December 29th	15¾	3¾	19½	23	6	29	19½	6	25½
Total gain	166¾	163¾	330½	161	147	308	181	137	318
Live weight December 29th	311¼	320¾	632½	329	295	624	333	286	619
Gain per cwt	115	104.3		95.8	99.3		119.0	91.9	
Average gain per cwt	109.6			97.5			105.5		

TABLE II

Showing amount of food consumed by periods and total foods consumed, cost of food, weight of food to make one pound of gain and cost of food to make one pound of gain.

Periods of two weeks.	Chopped Oats & Wheat. lbs.	Whole Oats & Wheat. lbs.	Mixture Chopped Oats, Wheat, Barley and Shorts. lbs.	Remarks.
1st period	112	140	150	
2d period	142¼	172	171½	
3d period	165¼	206	212½	
4th period	166	224	198¼	Oats $1.00 per cwt.
5th period	218½	220½	200½	Wheat $1.36 per cwt.
6th period	267	279	213	Shorts .90 per cwt.
7th period	287	320	226	Barley $1.00 per cwt.
8th period	244½	268	190½	
Food consumed by each lot	1603	1829½	1562¼	
Total cost of food	$ 19.68	$ 22.11	$ 19.94	
Amount of food to make a pound gain	4.8	6.	4.9	
Cost of food to make a pound gain	.059	.072	.055	

TABLE III—SUMMARY.

	Average daily feed.	Total feed.	Average Daily gian per pig.	Food for each pound of increase.	Total gain.	Gain per cwt. of pig.
Lot 1. Chopped oats and wheat	6.68	1603	1.37	4.8	330½	109.6
Lot 2. Whole oats and wheat	7.62	1829½	1.28	6.	308	97.47
Lot 3. Mixture	6.51	1562½	1.33	4.9	318	105¼
Kansas corn fed	11.14		2.03	5.45		105 34

TABLE IV

Showing weight of various organs, live weight, dressed weight and per cent. of shrinkage.

	Lot 1.		Lot 2.		Lot 3.	
	Chopped Oats and Wheat.		Whole Oats and Wheat.		Mixture Oats, Barley, Wheat and Shorts.	
	Sow.	Barrow.	Sow.	Barrow.	Sow.	Barrow.
No. of pig as shown in cuts	5	6	3	4	1	2
	lbs–oz	lbs–oz	lbs–oz	lbs–oz	lbs–oz	lbs–oz
Gross weight	311¾	320¾	329	295	333	286
Net Weight after 24 hours	264	271.5	270	244.5	275	241
Blood	6 1	5 12	5 8	6	6 4	4 15
Hair	2 14	2 12	3 3	2 10	3 8	3 13
Lungs	3	3 6	3	2 6	3 8	2 11
Heart	11	14	14	12	15	12
Spleen	2	5	2	3	4	2
Liver	4 10	3 12	3 14	3 2	4 7	3 3
Kidneys	10	9	8	8	9	9
Tongue	12	13	15	10	14	16
Intestines	27 7	26	31 14	26	27 10	28 8
Fat from Intestines	7 1	7 12	2 5	9 10	7 2	6 5
Leaf Fat	13 14	12 12	13 5	12 3	11 7	13 12
Per cent. Shrinkage	15.2	15.3	17.9	16.8	17.4	15.7
Average per cent. Shrinkage	15.25		17.35		16.5	

Oregon Agricultural Experiment Station.

Bulletin No. 28. October, 1892.

CHEMICAL DEPARTMENT.

The Soils of Oregon.

G. W. SHAW,
Chemist.

DUMONT LOTZ,
Assistant Chemist.

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F. L. WASHBURN, A. B.,.....*Entomologist.*
DUMONT LOTZ, M. Sc., A. C., ...*Assistant Chemist.*

THE SOILS OF OREGON

Geologically and Chemically Considered.

By G. W. SHAW.

Considerable time was spent last year in the Chemical Department of the Station in some investigations concerning Oregon soils. This work was undertaken because a knowledge of the soil, with its characteristics, lies at the very foundation of agricultural progress, and for this reason also it is too important a branch to be longer neglected. This fact is also being realized by other Stations throughout the country and they are now turning their attention to this line of work among the most prominent of which may be mentioned Maryland, Louisiana, and California.

A second reason for undertaking the work was that the data obtained might be used in a more complete agricultural and mineral survey of the State which it is hoped the Station may conduct as fast as the funds will allow.

It is well known that as to the benefits to be derived from *soil analysis alone* chemists are divided, while it is doubtless true that the general public attaches undue importance to it. The two opinions are held by equally strong adherents. The main ideas advanced by the opposition are the impossibility of securing a sample which will represent a general average; the difficulties in establishing a rule for determining deficiencies of plant food, because of the very material difference in the physical properties of the soil. The other side is equally ardent in the claim that there are vast tracts of land in the various states which are practically the same, of nearly uniform composition and physical condition, and that if a sufficiently large number of analyses are made, it is possible to establish a minimum limit for plant food elements. Prof. Hilgard, of the California Station, has shown that this is undoubtedly true of "virgin soils."

The opinions of the first class were the outgrowths of incorrect views put forth in the beginning of agricultural chemistry, and from the fact

NOTE.—The writer wishes to express his thanks to Mr. Dumont Lotz, the assistant chemist, for the excellent manner in which he has performed the greater part of the analyses given in this Bulletin.

that the results obtained were upon the worn out soils of the east and Europe. When, however, attention was directed to the soils of our newer states and territories, a different question was involved, and the translation of results obtained from *chemical and physical examinations combined* became a different matter.

In our western states, farmers, as a rule, have hardly brought their wild lands under cultivation, and the lands not having been exhausted, artificial fertilizers are very little used, but of late there has been an increase in the number of inquiries concerning them. Twenty years hence a scientific knowledge of fertilizers and the various soils will be necessary to successful farming in many portions of the northwest. Again, the methods of dealing with our alkaline soils is a problem which of itself presents a broad field for study, and together with this comes a study of the irrigating waters of the State.

We see the necessity of thus early in the work beginning to investigate along the above lines, and especially as to the mechanical and chemical condition of the soil.

The complete study of these questions is one involving a number of years and only a portion can be carried on at once. This Bulletin, then, simply sets forth the results so far obtained without attempting to draw definite conclusions, which must be left till more data can be obtained and comparisons made.

During the year several times we have been asked why the Station did not put in simple form some scientific facts concerning agriculture that the Bulletin readers in the State might the better understand some of the underlying principles with which the scientist has to deal. The law establishing the Station also states this as one of the functions of the workers, "to diffuse among the people useful and practical information on subjects connected with agriculture." In connection with the data of this Bulletin, then, is given some of the recognized facts with reference to soils and their relation to agriculture with the hope that they may be of service to some farmers.

Geology and Agriculture.

The subjects chemistry, geology and agriculture are so closely bound to each other that it is almost impossible to deal with one without crossing the line into the others. Although the rocks of any given formation may be quite different petrographically from others of the same formation, yet there are certain laws governing the different ages which furnish a comparatively safe guide in deciding to what general class soils belong. When the term "soil" is used it must be borne in mind that the word may be taken in two senses, the one meaning simply that medium in which plants grow; the other, and the more perfect definition, implying not only that medium, but also that from which is derived more or less plant food. It is in this latter sense that we speak of the soil in this Bulletin.

The surface of a country is divided by geologists into divisions according to the nature and characteristics of the rocks from which it is formed. The composition of each group of rocks is found to be quite uniform and

underneath their respective soils are found outcropping the various divisions of the rocks themselves.

ORIGIN OF SOILS.

Soils are formed by the natural disintegration of rocks, and signify that portion of rocks which after it has rotted down has been permeated by the air (and mixed with organic matter), and thereby has been changed, for the most part, to a class of compounds known as oxides, which are compounds of the various elements found in the rock with the oxygen of the air which plays a very important part in the disintegration of the rock. By the formation of these compounds the cohesion is weakened and the minerals making up the rock fall apart, and finally are worn to an inpalpable powder. Another very active agent in the decomposition of rocks is the carbon dioxide found in the atmosphere—that gas so necessary to plants and thrown off from the lungs of animals as a waste product.

This pulverization and decomposition is known as "weathering" and the various agents concerned are water, air, rain, wind and frost, which are constantly at work on the earth's surface. In the formation of soil cultivation and vegetation also assist very materially, since they expose fresh surfaces to the action of the various agents. Of course the more rapid changes take place near the surface, but the action is extended even to the hard rock, which becoming exposed to frequent alterations of dryness and moisture soon crumbles to fragments. In this connection the mechanical action of falling rain must not be forgotten, which, especially when heavy, washes away great quantities of surface soil leaving fresh surfaces exposed to the formative agents. In short suffice it to say that by the combined chemical and mechanical action of all these forces the parent rock is changed into the plant supporting soil. This is well illustrated today in the formation of the hard volcanic lavas of comparatively recent eruptions in our own State.

Soon after disintegration has begun the simplest form of microscopic vegetable life begins, and every where the soil is teeming with a great variety of forms of life which assist in preparing the soil and making it suitable for the various crops. Although the individuals producing these important changes are extremely small their countless numbers fully compensate for their size. When the organisms have done their work they die and their remains are left to form the necessary organic matter in the soil. From the putrefaction of these, and other vegetable accumulations, is formed a black mold called "humus."

During the decay of this matter the carbon unites with the oxygen to form carbon dioxide; the hydrogen unites with the nitrogen to form ammonia; and the ammonia undergoes further change resulting from the action of minute oxidizing germs which change the ammonia into nitric acid. This process of nitrification resulting in the conversion of ammonia into nitric acid through the action of living microbes, occurs only in the upper strata of the soil where access of oxygen for supporting the existence of the acting organisms is greatest; and is of a necessity increased by the porosity of the soil and by exposing new surfaces to action. The most re-

cent Rothamstead experiments demonstrate that little or no nitrification occurs in the subsoil; 2-3 feet being evidently the extreme depth at which the phenomenon occurs. The nitric acid of the soil below this depth is doubtless carried thither in the drainage or by diffusion.

The depth at which nitrification may occur, however, is capable of considerable variation, not only because of the physical condition of the soil, and access of oxygen, but depends largely on the chatacter of the crop grown ; leguminous plants, like the vetch and the clover, seeming to possess the property of considerably increasing not only the depth at which the transformation may occur, but also the activity of nitrifying organisms. *

Just how these plants bring about this change is not well understood, but this general fact is of vast agricultural importance, and has given this group of plants—the leguminoseæ—the term of "nitrogen gathers."

There are a large portion of our soils that are not formed by decomposition of rocks in place, but are the results of water deposition, either fresh or salt, being made of material prepared elsewhere and finely abraided from erosive action. In all running water fine material is carried to a lower level and the streams are continually moving soils from one place to another. These "alluvial soils," or "bottom lands," are of the most fertile nature from reasons which are very obvious.

CLASSIFICATION AND COMPOSITION.

The great bulk of soils is sand and clay and upon the variable amounts of these materials is based their popular classification. The sand and clay comes for the most part from the decomposition of the underlying rocks. The gradation between sandy and clayey soils are roughly expressed by such terms and distinctions as the following:

	Per cent. of clay or Impalpable matter.	Per cent. sand.
Heavy clay	75 to 90	10 to 25
Clay loams	60 " 75	25 " 40
Loam	40 " 60	40 " 60
Sandy loam	25 " 40	60 " 75
Light sandy loam	10 " 25	75 " 90
† Sand	0 " 10	90 " 100

Analyses of two typical soils of the State will serve to show the component physical parts. Soil 1 is from The Dalles and represents a great extent of country. Soil 2 is one very common in the Willamette valley and was taken from the foot hills south of Eugene.

		No. 1.	No. 2.
(1)	Coarse sand	30.4	80.5
(2)	Sand	24.0	2.5
(3)	Fine sand	12.2	3.0
(4)	Silt or clay	33.4	14.0

The remainder of mineral matter in the soil—not amounting to more than five pounds in one hundred of soil—consists of chemical compounds

* Stockbridge's Rocks and Soils.
† Johnson's How Crops Feed.

of lime, potash, soda, magnesia, iron, aluminum, manganese, chlorine, silicic acid, phosphoric acid, sulphuric acid, nitric acid and carbonic acid and water in varying proportions. Of the greater portions of the soil the plant makes no use except as a medium in which to fix its roots. It is the compounds of the above substances that constitute the plant food in the soil. The acids above mentioned are united with the bases to form the salts which occur as chlorides and silicates of potassium and sodium, calcium (lime) sulphate, phosphates of iron, calcium, magnesia, manganese and ammonium, and probably salts of soda, potash and lime with certain vegetable acids.

There are only three of these, lime, phosphoric acid and potash, which as a rule require attention so far as deficiency of plant food is concerned, for the other mineral substances are furnished in abundance by natural agencies. It must be remembered, however, that it is only the soluble portion of the material that the plant uses for food. It is these substances then that invite our attention. Just what constitutes a sufficiency of these materials for successfully growing a crop will differ somewhat with the nature of the crop and the physical condition of the soil. In an article published in 1881, Prof. Hilgard, than whom no one is more competent to judge, states the following as to the minimum percentage for a thrifty growth of general crops:

Lime.—0.10 per cent. in the highest sandy soil; 0.25 per cent. in clay loams; 0.30 per cent in heavy clay soils, and it may rise with advantage to one or two per cent. [The present indication is that we may consider .40 as a fair average for soils of the Willamette valley. G. W. S.]

Phosphoric Acid.—In sandy loams, 0.10 per cent. when accompanied by a good supply of lime. The maximum found in the best Mississippi table lands was 0.25 per cent.; in the best bottom land of the same region 0.30. His investigation in connection with the Northern Pacific survey also showed that this ingredient was more abundandant in the soils of Oregon and Washington than in the soils of California. * In the basaltic soils it may even run as high as .30 or more.

Potash.—The potash percentage of heavy clay upland soil and clay loams ranges from about 0.8 to 0.5 per cent.; lighter loams from 0.45 to 0.30; sandy loams below 0.30 and sandy loams of great depth may fall below 0.10 consistent with good productiveness and durability. Virgin soils with a less percentage than .06 he finds deficient. The same author also says in another article that no virgin soil having .50 per cent. or over of potash will wear out first on that side of the store of mineral plant food; and much less will suffice in the presence of much lime and humus.

Sulphuric Acid.—In the best soils this ingredient is slight, 0.02 per cent. is adequate; but it frequently rises to 0.10 per cent.

Iron.—He puts 1.5 to 4.0 as the ordinary percentage of ferric oxide in soils but little tinted; ordinary loams from 3.5 to 7.0; highly colored red lands 7 to 12, and sometimes upwards of 20.

Humus.—This is of great interest to us since it is the storehouse of the

* Cal. Exp. Station Report 1888.

nitrogen supply and its determination serves as a measure of the nitrogen. In oak uplands of the cotton states the range is usually between .70 and .80 per cent.; in the poorer sandy soils from .40 to .50 per cent.; in black calcareous soils 1.2 to 2.80 per cent. In western Oregon it is not uncommon to find 3 and even 6 per cent.

Whether or not the above are applicable to the soils of Oregon remains to be ascertained from a sufficient number of examinations from various portions of the State, and other data that may be collected, and this is a portion of the present work of the Station.

That comparison may be made the analysis of a few typical soils are given below:

	1V—Eugene Lane Co. Foot-hills.	1Q—Toledo Benton Co. Bottom land.	1J—College Farm Benton Co. Adobe
Insoluble Matter	63.02	52.72	72.70
Soluble Silica	8.77	14.54	5.93
Potash (K_2O)	.09	.33	.47
Soda (Na_2O)	.07	.09	.24
Lime (Ca O)	.60	.27	1.60
Magnesia (MgO)	.27	.25	1.03
Manganese (Mn_3O_4)	.02	.20	.10
Iron (Fe_2O_3) Aluminum (Al_2O_3)	15.90	18.31	9.23
Sulphuric Acid	.02	.03	.03
Phosphoric Acid	.16	.12	.05
Water and Organic Matter	10.51	12.90	8.00
Total	99.43	94.76	99.38
Humus	1.21	1.16	.76
Soluble Phosphoric Acid	.12	.07	.027

The above serve to give an idea of soil composition. For further illustrations the readers attention is directed to other pages in this bulletin.

TOPOGRAPHICAL AND GEOLOGICAL.

The State, comprising an area of 96,000 square miles, lies between 117° and 125° west longitude, and 42° and 46° north latitude. It is naturally divided into eastern and western Oregon by the Cascade mountains. The eastern portion is about 3000 feet above the level of the sea and embraces about two-thirds of the State. That part of the State together with a part of Washington often goes by the name of the "Inland Empire," since it is so surrounded by various mountain systems. The western portion may well be divided into a northern and southern portion, the first of which comprises the great Willamette valley and a portion of the Coast mountains. Throughout the entire western portion of the State there is a multitude of small streams furnishing an ample flow of water during the entire season. The Willamette valley, embracing about 5,000,000 acres, is by far the largest valley in the State. It is about 130 miles in length by 60 in width and extends from a low range of hills on the south (Calipooias) to Portland on the north. To show how well watered is this valley it mey be

weight of the intestines after the fat was removed. The per cent- of shrinkage is not very large, as compared with pigs of similar weight fattened on corn. There is only 14 per cent. difference between the average shrinkage of these pigs and a lot fattened on corn exclusively, at the Kansas agricultural college, under the direction of Prof. E. M. She ton. In table III containing a summary of the results, I have given some figures taken from the report of the above experiment. These figures show an increase in the average daily amount of food consumed, and in the amount of food to make a pound of gain; also, increase in the average daily gains, over the pigs fed in this experiment. In the gain per cent. of live weight, lot 1 is above the corn fed pigs, and lot 3 is nearly up to them. In the Kansas corn fed pigs, the pigs were older and larger than those in our experiment, hence, we would naturally expect a larger amount of food consumed. The larger gains might be accounted for, in that the corn fed pigs were in a thinner condition to start with, hence, the gains would be larger at the outset.

OBSERVATIONS ON CUTS.

Upon examining the photo-engravings, it will be seen that there is some difference in the relative amount of lean and fat in the various lots. Whether this is due to the individual characterics of the pigs, or to the feed, we will leave for our readers to judge. Cuts 1 and 2 show photographic reproductions of the meat from lot 3, or the mixed fed lot. The meat was photographed by the Station artist on the day following the slaughtering. The cuts were made through the loin and between the six and seven ribs. It will be noticed that there is a large per cent. of lean meat in these samples. Thought to be a larger per cent. than in either of the others, by all who examined the meat at the time of slaughtering.

The texture of the meat in this lot was all that could be desired. The lean meat was of a little darker colored than that of lot 1 or 2.

Cuts 3 and 4 show similar sections of lot 2, or those fed on whole grain. There is a little larger per cent. of fat in this lot, and the meat was not quite as firm in texture as that of lot 3.

Cuts 5 and 6 are from lot 1, or those fed on the chopped grain, unmixed. These samples show the thickest fat outside of

the lean, and the lean is the lightest in color. Some of this meat was sold to a leading butcher in the city, and he made the remark, that the lean meat was the lightest in color of any he had ever cut up. He compared it to the white meat of a chicken. In texture the meat was not as firm as that of lot 3.

Cuts Nos. 3 and 7 are copied from photographs of Kansas pork. They were from pork fattened at the Kansas Agricultural College, under the direction of Prof. E. M. Shelton.

Through the kindness of the Kansas Experiment Station authorities, we are enabled to present these cuts, made from photographs, by Prof. E- Pernot of our own Station.

No. 7 is the one to which we wish to call special attention. This represents similar cuts to those in our own experiment from a pig of similar weight, fed exclusively on corn. The pork does not differ materially in appearance except in the amount of fat in the loin cut, in which particular, there is considerable more in the corn fed pork, than in those of our own experiment. No. 3 is a sample of the shorts-bran fed lot, from the Kansas station, and has no particular interest in connection with our experiment. It could not well be excluded in making the cut hence its appearance in connection with No. 7.

I wish to acknowledge the faithful work of Mr. C. D. Thompson, who cared for the pigs during the feeding experiment.

H. T. FRENCH.

Summary of Answers to Circulars sent out.

The following questions were asked as a preliminary work in contemplated experiments in this important branch of agriculture. Answers were given covering the immediate vicinity as well as individual work in this line.

1.—At what age are pigs usually fattened? Twenty-five per cent. under 1 year; 50 per cent. 1 year and under 1½ years; 25 per cent. over 1½ years and under 2 years.

2.—What breeds are most common? Berkshire, Poland China, grades from these breeds and "scrubs" in the order named.

3.—Are the breeds kept pure to any extent? Breeds are not kept pure generally.

4.—What is the most common food for growing pigs? Pasture on green wheat or woodland pasture. Pasturing on stubble is a common practice.

5.—What is the most common food for fattening pigs? Wheat, oats,

barley and screenings in order named. Potatoes are cooked and fed in same localities.

6.—Is the grain ground or fed whole? Fifty per cent. report that grain is fed whole, while remainder use more or less ground material.

7.—Are foods mixed or fed separately? Fifty per cent. feed grain separately; remainder mix grains or feed in connection with potatoes or other vegetables.

8.—Are foods cooked to any extent? Only 8½ per cent. report that food is cooked, and that in case of vegetables.

9.—Average weight of pigs when slaughtered? Sixty per cent. report 150-200 pounds; 30 per cent. report 200-250 pounds, and 10 per cent. report 250-300 pounds.

TABLE I

Showing amount of gain by periods of two weeks, total gain, total weight, gain per hundred of live weight and average gain per hundred.

	Chopped Oats & Wheat.		Totals.	Whole Oats & Wheat.		Totals.	Mixture Chopped Oats, Wheat, Barley and Shorts.		Totals.
Dates of Weighing.	(1)	(2)		(1)	(2)		(1)	(2)	
September 1st	145	157	302	163	148	316	152	149	301
Gain September 15th	10	1	11	12	10	22	18	17½	35½
Gain September 30th	18	18	36	14½	18	32½	25	21½	46½
Gain October 15th	14	13	27	19½	17	36½	25½	24½	50
Gain October 30th	14½	19½	34	20½	17½	38	34	24½	58½
Gain November 14th	33	34½	67½	14½	27½	42	18½	15	33½
Gain November 29th	32½	35½	69	31	29½	60½	18½	16½	35
Gain December 14th	28	38½	66½	26	21½	47½	22	11½	33½
Gain December 29th	15¾	3¾	19½	23	6	29	19½	6	25½
Total gain	166¾	163¾	330½	161	147	308	181	137	318
Live weight December 29th	311¾	320¾	632½	329	295	624	333	286	619
Gain per cwt.	115	104.3		95.8	99.3		119.0	91.9	
Average gain per cwt.	109.6			97.5			105.5		

TABLE II

Showing amount of food consumed by periods and total foods consumed, cost of food, weight of food to make one pound of gain and cost of food to make one pound of gain.

Periods of two weeks.	Chopped Oats & Wheat. lbs.	Whole Oats & Wheat. lbs.	Mixture Chopped Oats, Wheat, Barley and Shorts. lbs.	Remarks.
1st period	112	140	150	
2d period	142¼	172	171½	
3d period	165¼	206	212½	
4th period	166	224	198¼	Oats $1.00 per cwt.
5th period	218½	220½	200½	Wheat $1.36 per cwt.
6th period	267	279	213	Shorts .90 per cwt.
7th period	287	320	226	Barley $1.00 per cwt.
8th period	244½	268	190½	
Food consumed by each lot	1603	1829½	1562¼	
Total cost of food	$ 19.68	$ 22.11	$ 19.94	
Amount of food to make a pound gain	4.8	6.	4.9	
Cost of food to make a pound gain	.059	.072	.055	

TABLE III—SUMMARY.

	Average daily feed.	Total feed.	Average Daily gain per pig.	Food for each pound of increase.	Total gain.	Gain per cwt. of pig.
Lot 1. Chopped oats and wheat	6.06	1003	1.37	4.8	330½	109.6
Lot 2. Whole oats and wheat	7.62	1829½	1.28	6.	308	97.47
Lot 3. Mixture	6.51	1562½	1.33	4.9	318	105¼
Kansas corn fed	11.14		2.03	5.45		105 3 4

TABLE IV

Showing weight of various organs, live weight, dressed weight and per cent. of shrinkage.

	Lot 1. Chopped Oats and Wheat.		Lot 2. Whole Oats and Wheat.		Lot 3. Mixture Oats, Barley, Wheat and Shorts.	
	Sow.	Barrow.	Sow.	Barrow.	Sow.	Barrow.
No. of pig as shown in cuts	5	6	3	4	1	2
	lbs-oz	lbs oz	lbs-oz	lbs-oz	lbs-oz	lbs-oz
Gross weight	311¾	320¾	329	295	333	286
Net Weight after 24 hours	264	271.5	270	244.5	275	241
Blood	6 1	5 12	5 8	6	6 4	4 15
Hair	2 14	2 12	3 3	2 10	3 8	3 13
Lungs	3	3 6	3	2 6	3 8	2 11
Heart	11	14	14	12	15.	12
Spleen	2	5	2	3	4	2
Liver	4 10	3 12	3 14	3 2	4 7	3 3
Kidneys	10	9	8	8	9	9
Tongue	12	13	15	10	14	16
Intestines	27 7	26	31 14	26	27 10	28 8
Fat from Intestines	7 1	7 12	2 5	9 10	7 2	6 5
Leaf Fat	13 14	12 12	13 5	12 3	11 7	13 12
Per cent. Shrinkage	15.2	15.3	17.9	16.8	17.4	15.7
Average per cent. Shrinkage	15.25		17.35		16.5	

SOILS OF LANE COUNTY.

This county has an area of about 7,000 square miles, with an average breadth of about 50 miles and being about three times this distance in length. About three-fourths of this county is hilly and mountainous. The table or hill lands bordering the valleys seem to be quite fertile, and produce well when brought under cultivation. A sample of this soil is the only one yet examined from this county and whether all will show as low percentages in potash as this is somewhat doubtful.

NO. IV—SOIL FROM LANE COUNTY.

Coarse material > .6 mm	5.70
Fine earth	94.30
Capacity for water	50.00
Hygroscopic moisture	2.00

ANALYSIS OF FINE EARTH.

Insoluble matter	63.02
Soluble silica	8.77
Potash [K_2O]	.09
Soda [Na_2O]	.07
Lime [CaO]	.60
Magnesia [MgO]	.27
Manganese [Mn_3O_4]	.02
Iron [Fe_2O_3] / Alumina [Al_2O_3]	15.90
Sulphuric Acid [SO_3]	.02
Phosphoric Acid [P_2O_5]	.16
Water and organic matter	10.57
Total	99.43
Humus	1.21
Ash	1.12
Soluble Phosphoric Acid	.04

The mechanical separation of the soil by an elutriating apparatus gave the following result: (See page 6, No. 2.)

IV.—The soil is a sandy loam and covers several sections in the foothills south of Eugene. Farther up the hills the soil becomes coarser and is underlaid with soft sandstone, which crumbles on short exposure. The vegetation is oak and wild grasses. The soil evidently has a good natural drainage and is easily worked. The dry lumps crush easily between the fingers and the soil does not become very sticky when wet. It is a soil that has been planted to fruit considerably of late. The physical condition of the soil would seem to warrant this, but the low percentage of potash would indicate that for the best results this ingredient will be needed in a few years.

The county is abundantly supplied with streams and springs. Considerable swale land is found in some parts of the county, mainly white land, but with good drainage this can be made productive. Taking Eugene as a starting point then going west about 6 miles is a low range of hills. From here we can look north for about 24 miles over a rich prairie through which flows the Willamette river, the course of which is rendered the more visible by the groves of balm, maple and shrubs. The hill land of the principal portion begins about 20 miles west from Eugene and is

is largely covered with fir timber—in fact the whole region abounds in forests of fir, hemlock and cedar.

Further analyses from this rich section will shortly be made.

SOILS OF LINN COUNTY.

Of Linn county there are only about 1300 square miles that is suitable for agricultural purposes. "The arable portion of the county is about evenly divided into prairie and rolling land. The prairie is not a dead level, but slightly undulating, affording plenty of slope for good drainage to the Willamette river which bounds the county on the west along its whole length. The soil of the prairie lands is a rich, dark, clayey loam, of the general character of that of the whole Willamette valley." For the most part the soils are sandstone and basaltic. About the Santiam country the formations are porphyritic and granitic which are a contiuation of similar rocks to the north and south—a part of the same that outcrops on the west of the Cascades. Only one soil has been analyzed from this county.

1W—SOIL FROM LINN COUNTY.

Coarse material > .6 mm	22.90
Fine material	77.10
Capacity for water	44.00
Hygroscopic moisture	7.55

ANALYSIS OF FINE EARTH.

Insoluble matter	57.82
Soluble silica	7.23
Potash [K_2O]	.15
Soda [Na_2O]	.07
Lime [CaO]	3.51
Magnesia [MgO]	.21
Manganese [Mn_3O_4]	.12
Iron [Fe_2O_3] / Alumina [Al_2O_3]	16.89
Sulphuric Acid [SO_3]	.02
Phosphoric Acid [P_2O_5]	.11
Water and organic matter	13.07
Total	99.20
Humus	1.88
Soluble Phosphoric Acid	.09

1W.—This is a light loam, black in color, sent from Lebanon by Mr. John Withers. The soil to change of color, is from 18 to 24 inches, and the subsoil is about 2 feet deep. The soil grows fir, maple, oak and ash. As will be seen it carries a high percentage of lime and clearly shows a lime vegetation. It has a high moisture coefficient and evidently has good natural drainage. The soil should be easily worked and though the potash is not high, yet with the heavy percentage of lime it is fairly supplied and with thorough tillage is not apt to be deficient in this quarter. It is an excellent all around soil.

Soils From Eastern Oregon.

Only two soils have been as yet analyzed from this portion of the State. The nature of the rocks and soils has been mentioned on previous pages of this Bulletin to which the readers attention is invited. The following table gives the analysis:

EASTERN OREGON SOILS.

	No. 1Y Cross Keys Crook Co. Linton.	No. 1Z Meacham Union Co. A. H. Todd.
Coarse material > .6 mm	4.40	.40
Fine earth	95.60	99.60
Capacity for water	36.00	61.00
Hygroscopic moisture	3.85	4.70
ANALYSIS OF FINE EARTH.		
Insoluble Matter	76.69	65.75
Soluble Silica	8.47	8.95
Potash (K_2O)	.83	.84
Soda (Na_2O)	.20	.23
Lime (Ca O)	1.21	.76
Magnesia (MgO)	1.11	.24
Manganese (Mn_3O_4)	.04	.02
Iron (Fe_2O_3) / Aluminum (Al_2O_3)	9.11	14.85
Sulphuric Acid [SO_3]		trace
Phosphoric Acid [P_2O_5]	.08	.07
Water and Organic Matter	3.35	8.09
Total	101.09	99.80
Humus	.41	1.10
Soluble Phosphoric Acid	.11	.02

1Y.—As will be seen from the above data this is a soil of very fine texture. It is a light gray soil which darkens slightly on moistening. It is abundantly supplied with potash but phosphoric acid is deficient. The main growth is bunch grass and sage brush, and to one unacquainted with its peculiarities the soil would not be considered favorably, although experience shows that the soils of this same character produce well provided they are given moisture.

1Z.—This soil in appearance is much like the one mentioned just above. It does not, however, contain so much inert matter, and the supply of humus is better. Like the above the phosphoric acid is present only to a very limited extent. Yet since these soils have a good supply of lime the conditions are the more favorable on that account.

In conclusion of this the first of a series of Bulletins on this important subject of soils it should be said that in the present state of our knowledge on this subject and the data in hand, it is often impossible to go beyond conjecture on some questions, yet by multiplying the results on the one hand, and by careful observation on the other the future work and benefit to be derived will be very much aided, and the results will be all the more helpful to the agricultural industry of the State.

APPENDIX.

Since the Station receives so many inquiries as to what it is prepared to do, and also that the Chemical Department may be of the greatest possible use to citizens of the State and come in closer contact with them these few pages are added. The department also takes this means to answer in a general way a few standing questions which are continually being asked. The Chemical Department of the Station is prepared to analyze and test

soils, waters, butter, milk, cattle-foods, fertilizers, gypsum, and other agricultural products, and to make such mineral analyses as may be of interest to the State, and as we may have time. Also to give information on such subjects of agricultural science as may fall within its province.

All analyses are made *free of charge*, but are subject to the following conditions: 1.—All samples for analysis must be taken according to the directions of the Station. 2.—All questions concerning the sample will be answered truthfully by the person sending the samples. 3.—That the Station is free to publish all results of analyses made for the benefit of the public.

The Station will not undertake work the results of which are not at its disposal to publish.

The laboratory of the Station is complete in all particulars, although not so large as that of many stations. For that reason it is not possible to turn out work as rapidly. It must be borne in mind that to correctly analyze a substance is not a matter of a few minutes, but more often it is a matter of several days work; and that there is always regular experimental work being carried on which as a rule cannot be interfered with, hence all who send samples must be patient and bide their time. *All samples received are numbered in the order they are received and so analyzed*, the analysis then being reported to the party sending the sample.

In all cases where samples are sent to the Station for analysis *all charges must be prepaid.*

DIRECTIONS FOR SAMPLING.

For ordinary water analysis, one gallon of water should be sent; for mineral water analysis two gallons. The water should be put in clean glass bottles, filled completely full, and corked with *clean, new corks.*

Samples of milk should not be less than a pint, and the milk should be thoroughly mixed before a sample is taken, and the bottle completely filled.

Samples of rock, coal, etc., should be so taken as to be a fair average sample, invariably taken from below the surface.

Fertilizers are sampled by taking a quantity from the top middle and bottom, intimately mixing on paper. They should be sent in *clean, dry bottles well corked.*

It is essential that the fertilizer samples be certified to and certificates for this purpose will be furnished by the Station. Each sample of fertilizer must be accompanied by the following data:

1.—Sampler's name. 2.—Brand. 3.—Name and address of the manufacturer. 4.—Name and address of the dealer. 5.—Date of taking sample. 6.—Price per pound, ton or package. 7.—For what purpose used. 8.—Percentage of valuable ingredients claimed by manufacturer or dealer. 9.—Such other information as the Station may require.

Directions for sampling soil will be sent on application.

The department is ever ready to give any information within the province of its work, and solicits the co-operation of those interested in the welfare of the State. All communications relative to analyses and matters pertaining to chemical work should be addressed to

G. W. SHAW, Chemist, Oregon Exp. Station,
Corvallis, Oregon.

Oregon Agricultural Experiment Station.

Bulletin No. 22. January, 1893.

HORTICULTURE.

GEORGE COOTE, Horticulturist.

Comparative Test of Small Fruits and Notes.

Comparative Test of Vegetables with Notes.

Renovation of Old Orchards.

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

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EXPERIMENTS WITH SMALL FRUITS AND VEGETABLES.

The season of 1892 was favorable to the growth of the strawberry, with the exception, that two or three late frost cut the bloom. Most of the varieties under test at the station were planted in 1888. They have done fairly well, but during the past season have shown a decided improvement over previous years; thus proving, that under good cultivation, the plants can be kept in bearing condition, for at least four years. There is not so much danger of the plants becoming exhausted, as the laborer. The above plants were subjected to different methods of cultivation. Some were permitted to grow at will, and have become matted. The vitality of the last mentioned plants gave way at an early age, about the end of the second year. The best method to keep the strawberry in good bearing is to give the plants a thorough, deep cultivation with the cultivator, at the earliest opportunity in Spring. The later cultivations with the hoe or cultivator should be shallow, not exceeding three inches. If the later cultivations be too deep it destroys the rootlets and prevents rapid growth. In dry weather the oftener the surface is stirred the better, say every week, as thus moisture is kept near the surface.

Care should be taken to have the soil well pulverized. As soon as runners commence to be thrown out they should be taken off, the object being to prevent the strength of the plants from being thus wasted. If a supply of young plants is needed only four or five should be permitted to grow on each plant; but these should not remain connected with the parent plant long enough to make roots. As soon as the young plants are large enough to be taken off, they should be transferred to a propagating bed. After the fruiting season is over, it is recommended that all old leaves be cut off with the scythe, time however, being given for the foliage of the plants to ripen, before the old growth of the leaves is removed. After all dry leaves have been raked up from the beds a good supply of stable manure should be spread over the beds and well stirred into the soil. In two or three weeks, the plants will begin to make new growth. To secure fine fruiting plants for the coming season, strong crowns must be made in the fall as this is the season in which these crowns, or bloom buds are formed for the coming year's fruiting.

The varieties that have proved themselves most productive, during the past four years, are: Haverland, Burt, Warfield, Pearl, Glendale, and Henderson.

In the following table will be found a comparison of the productive val-

ue of plants that have been planted four years, and others, that have been planted three years. It will be seen that the superiority of the 4 year old plants is plainly marked; 12 plants of each variety were set apart for the purpose of this comparison.

No.	Variety.	Age of plants 4 years Wt. of fruit in oz.
1.	Bomba	116¾
2.	Cloud	40¾
3.	Dutter	73¾
4.	Haverland	220¼
5.	Hampden	104⅞
6.	Henderson	127⅝
7.	Jessie	61⅜
8.	Louise	37½
9.	Mammoth	58
10.	Monmouth	36
11.	May King	105¾
12.	Ohio	111⅜
13.	Pearl	147¾
14.	Van Deman	29¼
15.	Warfield	152⅛
16.	Glendale	136⅞

No.	Variety	Age of plants 3 years Wt. of fruit in oz.
1.	Bomba	127
2.	Cloud	5⅜
3.	Dutter	98¾
4.	Haverland	106¾
5.	Hampden	104¾
6.	Henderson	35¾
7.	Jessie	35¾
8	Louise	54⅜
9.	Mammoth	81
10.	Monmouth	29½
11.	May King	77½
12.	Ohio	403¾
13.	Pearl	28½
14.	Van Deman	32⅛
15.	Warfield	81½
16.	Glendale	56¾

Descriptive Notes on Strawberries.

Bomba—*P. Berry good shape, large seeded, medium size. Color dark red, flavor sub-acid; soft, will not ship well.

Cumberland.—P. Conical, of medium size, seed large, rather soft and fibrous; not extra in flavor, does not prove itself to be very productive, is a late variety.

Cloud.—†I. Berry very firm, but small, seeds large, also has a very large core; plant vigorous, not very productive.

Dutter.—P. Fruit large, very firm, good flavor, about medium in productiveness.

Haverland—I. Berry oval, somewhat soft; very productive, lasts well through the season, an excellent variety for a near market.

Hampden.—I. Berry, a little over medium size; very good flavor, with a combination of sugar and acid; midseason.

Henderson.—I. A vigorous grower; produces but few runners; berries conical, with long neck; color red, firm, of excellent flavor.

Jessie.—P. Plants vigorous, berries good size, heart shape, clear red, somewhat soft, quality medium, has not proved to be very productive.

Louise.—P. Berry firm and of good size, conical, good flavor and color, very light producer

Mammoth.—P. Berry large, flesh firm, of good flavor; seeds small, irregular in shape, good only for home use and for exhibition.

May-King.—P. Plant vigorous, berries smooth, obtusely conical and regular; color bright red, firm and of good flavor; an early variety.

Monmouth.—P. This variety is of but little value here. The yield has been light; has produced a few good berries.

Ohio—I. Plants very vigorous, berries slightly irregular, seed sunk into the flesh, firm, a good late variety.

Pearl.—P. Berry conical, hull not easily removed; neck long, irregular; flesh firm; good for home use.

Van Deman.—P. This is a new variety of excellent flavor. Plant of good habit; dark green foliage, berry medium to large; color dark red, with bright yellow seed, making it very attractive.

Warfield—I. Berry conical, somewhat soft, a good producer; color deep red, moderately firm; is a little tart, lasts well through the season, and one of the most profitable varieties.

Glendale.—P. Berry irregular, conical, firm; has a large core, flavor verry acid.

Summit.—I. Berry, large oval to round, has the flavor of the wild berry, too soft for long transportation, good for home use, late.

Burt—P. Berry conical, firm, good flavor; quite productive, a late variety.

Jucunda—P. Berry excellent flavor, rather soft, color of fruit dark red; quite prolific.

Sharpless—P. Berry nearly round, firm, prolific, a good market variety,

Peabody—P. Berry turbinate; large, flesh crimson, a good variety for exhibition purposes.

Banquet—This variety was donated by Mr. J T Hawkins of Mountainville, N.Y. Plant, dwarf habit; color of fruit dark red, changing to pink at the apex; oblong, medium size, fruit of an excellent flavor, melting; mid-season.

*P. Perfect.—Flower having stamens and pistils.
†I. Imperfect.—Flower having pistils alone.

VARIETIES.	Date of Blooming.	Date of first picking.	Date of last picking.	Average picking.	Weight of 10 berries.	Yield per plant.	Average size of berry.
	m d	m d	m d	oz.	oz.	oz.	
Bomba P.	4 20	5 28	6 24	8.98	3.15	11.68	1⅜x1¾
Burt P.	4 24	6 1	6 30		3.75	14.25	1¼x1⅜
Banquet P.	4 22	5 28	6 24	3.3		2.78	1¼x1
Bubach	4 22	5 30	6 24	4.52	5.⅓	6.78	
Cloud I.	3 21	5 28	6 24	3.7	3.31	3.41	1x1⅛
Cumberland P.	4 27	5 30	7 5	4.52	3.	6.78	1½x1¼
Dutter P.	4 20	6 1	6 24	2.08	3.38	11.11	1⅞x2
Glendale P.	4 18	5 30	5 24	11.35	3.54	11.35	1¼x1⅛
Gandy P.	4 29	6 11	6 30	12.30	3.71	8.2	1¼x1¼
Hampden I.	4 18	5 30	6 24	8.75	2 94	9.55	1¼x1¼
Haverland I.	4 23	5 25	6 30	14.68	3.29	18.35	1⅞x1¼
Henderson P.	4 16	5 28	6 30	9.82	3.8	10.64	1½x1
Jessie P.	4 17	6 1	6 29	4.72	4.18	2.98	1⅛x1¼
Jucunda	4 25	5 27	7 5	4.95	3.	5.36	1⅛x1½
Louise P.	4 26	6 3	6 24	2.8	4.13	4.12	1½x⅞
Mammoth P.	4 25	5 30	6 24	4.86	4.69	4.86	1⅞x1½
Monmouth P.	4 20	6 1	6 27	3.27	3.07	4.	1¼x1⅛
Michel's Early P.	4 18	5 27	6 22	6.83	2.47	6.03	1¼x1¼
May King P.	4 19	5 27	6 26	7.55	2.34	8.81	1⅛x1
Ohio I.	4 25	4 9	6 30	12.38	3.	8.45	1½x1⅛
Pearl P.	4 25	5 27	6 24	11.34	3.25	12.28	1⅛x1
Pine Apple P.	4 27	5 30	6 30	6.06	3.25	6.06	1½x1⅛
Peabody P.	4 18	6 3	6 30	9.86	3.13	9.04	1½x1⅜
Summit I.	4 17	6 3	6 24	7.61	4.56	6.85	
Sharpless P.	4 18	6 3	6 30	9.86	3.13	9.04	1x1¼
Van Deman P.	4 15	5 27	6 24	2.46	3.25	7.37	1¼x1¼
Warfield I.	4 24	5 28	6 26	11.7	2.63	12.48	1⅛x1
Oregon Ever-bearing P.	4 16	5 30	8 9		3.¾	6.99	

A Comparative Trial of Peas.

The varieties of peas on our trial grounds during the season of 1892 numbered 25. All were grown under like conditions. New Alaska proves to be the earliest, improved Daniel. O. Rourke following 5 days later.

American Wonder, Blue Peter, and Extra Early came to maturity one day later than the improved Daniel O. Rourke.

The data given below shows the number of days from planting to the time of blooming; also to the time of edibility and market maturity. The different varieties were all sown on the 8th day of March, 1892.

	SOURCE	VARIETY.	Date of germinating.	Date of blooming.	Edible maturity.	Market maturity.	No. of days of edible maturity.
			m d	m d	m d	m d	
1	Horticultural Dept	American Wonder	3 22	5 22	6 10	6 20	95
2	Henderson	Blue Peter	3 19	5 21	6 10	6 15	95
3	"	Bliss Abundance	3 18	6 3	6 20	6 24	105
4	"	Black-eyed Marrowfat	3 19	6 3	7 1	7 8	110
5	Childs	Childs' Universal	3 17	5 21	6 1	6 1	97
6	Horticultural Dept	Anticipation	3 21	6 1	6 24	6 29	109
7	Henderson	Evolution	3 19	6 6	6 20	6 30	105
8	"	Extra Early	3 20	5 30	6 10	6 18	95
9	"	Forty Fold	3 17	5 31	6 20	6 30	105
10	"	Fillbasket	3 19	6 3	6 28	7 3	113
11	"	Gladiator	3 20	5 29	6 21	6 27	106
12	"	Horsford's Market	3 20	5 31	6 19	6 30	104
13	"	Heroine	3 22	6 2	6 20	6 28	105
14	"	Horsford's Market Garden	3 21	5 1	6 18	6 29	103
15	Horticultural Dept	Laxton's Alpha	3 20	5 24	6 12	7 8	97
16	Henderson	Melting Sugar Edible Pod	3 18	6 5	6 26	6 30	111
17	"	New Dwarf Edible Pod	3 20	5 28	6 18	6 26	103
18	Hort. Dept	New Alaska	3 19	5 20	6 4	6 10	89
19	Henderson	Pride of the Market	3 19	6 4	6 20	6 20	105
20	Hort. Dept	Strategem	3 20	6 5	6 10	6 28	95
21	"	Telephone	3 22	6 2	6 15	6 22	100
22	Henderson	Telegraph	3 21	6 3	6 15	6 28	100
23	"	The Major	3 19	6 3	6 19	6 30	104
24	"	Sanders's Marrow	3 19	6 6	6 18	7 1	102
25	"	Improved Dan O'Rouke	3 19	5 29	6 9	6 12	94

Descriptive Notes on Peas.

Anticipation.—Vines of medium growth slightly branching, light green. Pods two and one half to three inches long, four to six peas in a pod.

American Wonder.—Vine stout, very branching, height from 12 to 16 inches. Pods two and a half to three inches in length, from 5 to 8 peas in a pod, very dark green, bearing pods in pairs.

Blue Peter.—Vines very stout, 12 to 14 inches high, branching, foliage dark green, pods in pairs, unevenly filled, and uneven in size. From 2¼ to 3 inches in length, 4 to 7 peas in a pod, of good quality.

Bliss Abundance.—Vines stout, branching two to two feet 8 inches high. Smooth, pods curved backward, 3 to 3¼ inches in length.

Blackeyed Marrowfat.—Vine from 4 to 5 feet high, branching; foliage light green. Pods 2½ to 3 inches in length, four to six peas in a pod.

Child's Universal.—Vines of medium growth, from 2 to 2 feet 6 inches high. Pods 2 to 2½ inches long, 6 to 7 peas in a pod of fair quality.

Evolution.—Vines 2½ to 3 feet high, stout, and branching, of a dark green color. Pods 3 to 4½ inches long, eight to nine peas in pod.

Extra Early.—Vines stout, from 2 to 2½ feet high. Pods 3 to 3½ inches long, five to seven peas in each pod.

Forty Fold.—Vines of medium growth, pale green slightly branching, pods 2½ to 3 inches long; 6 to 8 peas in a pod.

Fillbasket.— Vine 3 to 3½ feet high, branching at the ground; foliage dark green; pod 2½ to 3¼ inches long, 6 to 8 peas in a pod.

Gladiator.—Vine stout, throwing out from 8 to 9 branches; dark green, from 2 to 2¼ feet high; pods 3½ to 4 inches in length, recurved, from 8 to 9 peas in a pod.

Horsfords's Market.—Vines strong, branching, dark green; 2 to 3 feet high; pods 2¾ inches long, containing 5 to 7 peas.

Heroine.—Vines stout, foliage pale green, from 2½ to 2¾ feet high; pods 3¾ to 4¼ inches long, 7 to 9 peas in a pod.

Laxton's Alpha.—Vines of medium strength; from 3 to 4 feet high; pods 2½ to 3 inches in length, containing from 6 to 7 peas.

Melting Sugar Edible Pod.—Vine of medium strength, 3½ to 4 feet high; pods 3½ to 4 inches long, 6 to 8 peas in a pod. The whole pod may be used for cooking after the same manner as "string beans."

New Dwarf Edible Pod.—Vine of medium growth, 1 to 1½ feet high; foliage dark green; pods from 2½ to 3 inches in length 4 to 5 peas in a pod. May be used in the same way as the last described.

Pride of the Market.—Vines strong, branching, dark green, from 2 to 3 feet high; length of pod, 4 to 4⅓ inches, 7 to 8 peas in a pod; of good quality.

Strategem.—Vines very strong, foliage light green; from 2 to 2¾ feet high; pods 3 to 3½ inches in length; 5 to 7 peas in a pod, of good quality.

Sander's Marrow.—Vines of rank growth and light green color; from 3½ to 5 feet high; branching; pods 2¾ inches in length, mostly produced in pairs; not evenly filled.

Telephone.—Vines 3 to 4 feet high, color light green, branching; pod 3 to 3¾ inches long containing from 6 to 8 peas of excellent quality.

Telegraph—Vines strong, color pale green, branching, 4½ to 5 feet high; pods 3¾ to 4¼ inches long; 6 to 8 peas in pod, of very good quality.

The Major.—Vines stout, branching freely; color of foliage dark green; from 2½ to 3 feet high; pods 3 to 3½ inches in length, containing from 5 to 7 peas.

Improved Daniel. O. Rourke.—Vine of medium strength; color light green; from 2½ to 3 feet high; pods slightly recurved and compactly filled; two to two and three-quarter inches long, of good quality.

Cabbage.

Continued trial of cabbage from seed supplied by FRANCIS BRILL, L. I.

For the earliest varieties of cabbage, we would recommend Early Jersey Wakefield, and Early Etampes; for the next earliest, the Large Jersey Wakefield, and Newark Flat Dutch; for late varieties as between, the

Perfection Drumhead, Savoy, and Improved Late Drumhead, the Savoy is to be preferred as it is much hardier and keeps longer. Owing to the dryness of the season and the comparatively poor condition of the ground the showing is not as good as it otherwise would have been; but all the varieties proved to be perfect specimens, and true to name. All the seeds were sown March 12, 1892.

VARIETY.	Date of Vegetating.		Date of planting out.		Edible maturity.		Marketable maturity.		Weight of head.	Diameter of head.	Depth of head.
	m	d	m	d	m	d	m	d	lbs.	inch's	inches.
Early Jersey Wakefield	3	18	5	28	7	12	7	17			
Improved Late Drumhead	3	18	5	28	8	14	8	24	4½	6⅛	7⅛
Extra Early Etampes	3	17	5	28	7	12	7	17	5¼	8¾	3¾
Louisville Drumhead	3	21	5	28	8	7	8	14	4¾	5⅛	8¼
Large Jersey Wakefield	3	20	5	28	8	1	8	7	4⅛	7¾	6¼
Premium Flat Dutch	3	19	5	4	8	4	8	11	4⅛	8	5½
Bristol Flat Dutch	3	19	5	30	8	12	8	19	4	5½	7½
World Beater	3	20	5	30	8	6	8	14	5⅜	8½	7
Newark Early Flat Dutch	3	21	5	30	8	2	8	8	5⅛	8½	6
Perfection Drumhead Savoy	3	18	5	30	8	24	9	1	2	5¼	6¾
Fottler's Drumhead	3	19	5	30	8	4	8	12	2¾	5	7¼
Succession	3	18	5	30	8	4	8	11	4¼	8	5
Nonsuch	3	21	5	30	8	12	8	30	3	5	6¾

Results of Test of 11 Varieties of Corn.

VARIETY.	Source.	Date of vegetating.		Date of blooming		Date of edible maturity.		Date of marketable mat.		REMARKS.
Cory Early	Mays.	5	25	7	22	8	10	8	27	A good early variety, productive.
Crosby's Early	"	5	26	7	28	8	29	9	5	
Early Adams	"	5	23	7	22	8	17	8	25	A second early for marketable purposes.
Extra Early Adams	"	5	25	7	22	8	9	8	17	Very early, medium sized ears, excellent.
Early Red Blazed	"	5	24	7	28	8	24	9	1	Large well filled ears, of fair quality.
Early Minnesota	"	5	22	7	28	8	22	8	31	Ears of medium size, of very good quality.
Stowell's Evergreen	"	5	23	8	10	9	3	9	9	One of the best for general purposes.
Early Mammoth	"	5	27	8	9	9	5	9	12	A strong growing variety of good quality.
Gold Coin	"	5	24	8	16	8	19	9	18	A good variety with well filled ears.
Country Gentleman	"	5	27	8	15	8	15	9	18	Greatly resembles the Shoe Peg.
Late Mammoth	"	5	25	8	11	9	9	9	16	Resembles early Mammoth.
California Sweet	Childs.									Made a strong growth, but did not mature.

A Comparative Trial of Beans.

The following varieties of beans were planted on May 5 and 11; but, owing to the wetness of the early spring, the ground could not be gotton into such condition as was desired. No fertilizers were used. Twenty-five plants of each variety were taken for the test. Owing to the dryness of the summer, the yield was not as good as it should have been. Careful notes were taken of each variety during the season of growth. The product

of each will be found in the following table. The Southern Prolific stood the drought best, and continued to produce until cut by frost. It is very productive and of excellent quality.

VARIETY.	SEEDSMAN	Date of Planting.	Date of Vegetating.	Date of Blooming.	Date of edible maturity.	Date marketable maturity.	Date of Ripening.	Wt. of Beans in lbs., and oz. 25 plants.		Average height of plants.
Black or German wax	G. Starrett.	5 4	5 25	7 5	7 13		8 14	2		10 in
Black-eyed wax	E J Bowen	5 11	5 30	6 30	7 10	7 15	8 12	2	6½	8
Burpee saddle-back wax	Burpee	5 4	5 20	7 3	7 13	7 18	8 13	2	12½	11
Black Lima	"	5 4	5 22	7 16	8 25	8 26	9 12	2	3	42
Burpee's Sunshine	"	5 4	5 21	7 15	8 3	8 14	9 26		12½	60
China Red eye	Starrett	5 4	5 22	6 30	7 12	7 18	9 12	2	12	9
Cranberry	Bowen	5 11	6 10	7 2	7 15	7 20	9 16	1		12
Childs' Pole Bean	Childs	5 4	5 20	7 10	7 27	8 1	9 31	1	1	24
Dw'f Bush or black-eyed wax	Bowen	5 4	5 24	7 10	7 12	7 15	9 11	2	6½	9
Dwarf Black wax	L L Mays	5 4	5 25	7 10	7 15	7 21	8 15	2	4½	6
Refugee or 1000 to 1	"	5 4	5 21	7 12	8 3	8 5	8 31	2	7½	6
Dwarf Horticultural	Starrett	5 4	5 24	7 6	7 15	7 21	8 18	1	3	36
Early long yellow six weeks	Mays	5 11	6 5	7 1	7 12	7 15	8 12		13½	9
Early six weeks	Starrett	5 4	5 20	6 29	7 12	7 16	8 12		11	9
Early dwarf or bush golden	Bowen	5 4	5 20	6 29	7 13	7 20	8 14	1	6½	6
" " " mohawk	"	5 4	5 25	6 18	7 15	7 20	8 13	1	12½	11
" or bush German wax	"	5 4	5 24	7 1	7 12	7 18	8 14	1	8	9
" " white wax	"	5 4	5 20	6 29	7 13	7 20	8 14		12½	6
Golden wax	Mays	5 4	5 20	6 28	7 9	7 15	8 11	2	4½	11
Southern Prolific	Bowen	5 11	5 28	8 20	9 15	9 29		7	8	73
Ivory Pod wax	Starrett	5 11	6 3	7 4	9 20	7 25	8 30	1	9	12
Indian Chief	"	5 11	5 30	7 13	9 27	7 31	9 2	1	10	34
Refugee	"	5 4	5 21	7 15	8 3	8 6	9 26	3	12	12
Red Valentine	"	5 4	5 20	7 5	7 19	7 23	9 24	1	1½	8
New Kidney wax	Mays	5 4	5 20	7 3	7 8	7 15	9 12	1	5	10
White wax	Starret	5 4	5 21	6 30	7 20	7 15	9 25		12½	7
Will w Cap Lima	Burpee	5 4	5 22	7 18	8 26	8 30	9 30	3	1½	48

Experiment with Sea-Kale.

On the 10th of April 1889, the seed was sown in the open ground, in a single row, on soil that had been well subsoiled. As soon as the plants were large enough, they were thinned out to a foot apart. The soil was kept well stirred with the hoe between the plants, at frequent intervals during the summer. By fall the plants had made a strong growth. On Feb. 12th 1890, the plants were taken up, and planted in a row across the plot, eighteen inches apart. The ground had previously been well prepared by spading to the depth of eighteen inches, and well fertilized with stable manure. Before planting, the crown buds were cut from the plants. This precaution was taken to prevent the plants from producing flowering stems, which otherwise, would have been the case.

The plants were set in the following manner: a line was stretched across the plot; a small trench eight inches deep was made, and in this the plants were set eighteen inches apart, placing them so that the crown was about an inch under the surface of the soil.

After the plants were covered with earth, a mulching of manure was given them. Early in the spring, as soon as the plants made their appearance above the surface of the soil, they were given a shallow cultivation with the digging fork. The plants again made a strong growth, with from two to four crowns each. In the month of December 1891, all of the old foliage was re-

moved and the ground around them again cultivated with the "digging fork."

The method of forcing the sea-kale is as follows: first, placing an inverted nail keg over each plant, for the purpose of bleaching it. Over this was placed fifteen inches of fresh stable manure and leaves. The third day, the manure began to give out a gentle heat. In three weeks the plants showed signs of growth, and on March 4th, were ready for table use. The Sea Kale is a valuable vegetable, inasmuch as it can be easily forced for use from December until April, provided a succession of plants are at hand for the purpose.

The accompanying cut represents the Kale as grown on our trial grounds, bunched, and ready for market, For culinary purposes it is treated in every way the same as asparagus.

Gooseberries.

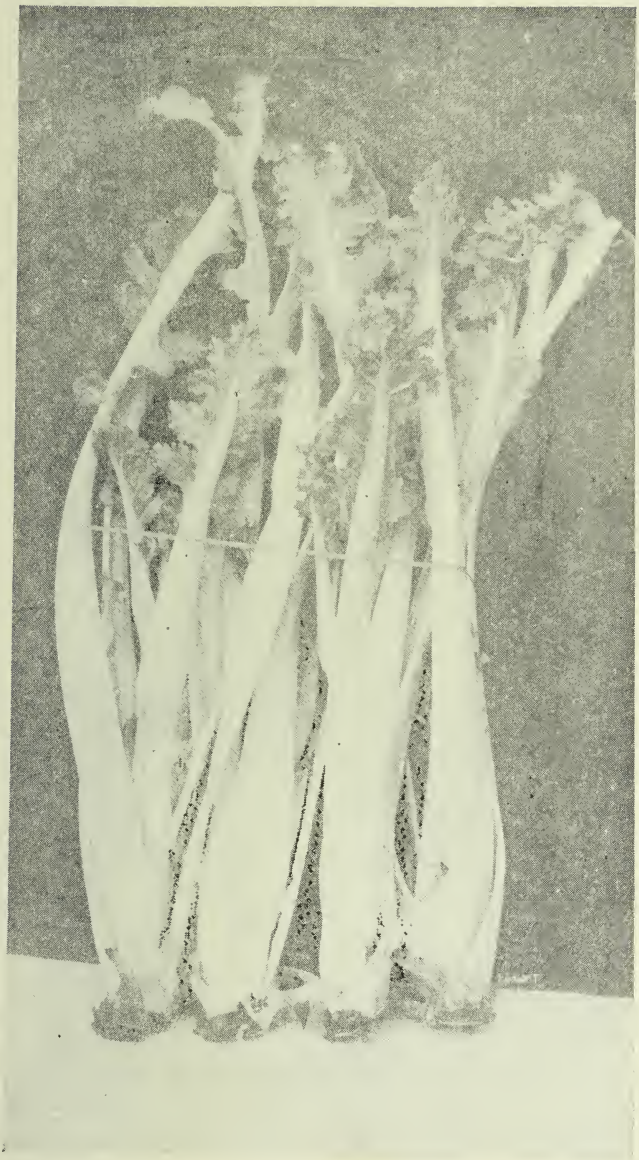
In connection with the test of varieties of gooseberries it is desirable to give a few practical hints on their propagation, pruning, and culture.

The gooseberry is a greedy feeder; it is therefore necessary to supply it well with good stable manure, the well rotted being preferable. This should be worked into the soil with a digging fork, to prevent the roots from being damaged, as would be the case if it were dug in with a spade. The best time to put in cuttings, is in the fall; vigorous firm wood should be selected. If the cuttings can be taken off close to the branch from which they spring, so much the better. The joints should be cut off so as to leave the cuttings from ten inches to one foot in length. The buds on the lower end of the cuttings must all be removed. This disbudding should be carried to a height of six or eight inches from the base. By so doing suckers may be prevented. If cuttings are inserted early in the fall success is almost certain. Propagation from cuttings has a decided advantage over the process of layering. In the former case the suckers can be entirely done away with, while in the latter, they cannot be prevented. Layering is a sure mode and may be resorted to when any particular variety is required to be speedily obtained, though the plants will not be as handsome as those raised from cuttings.

Pruning

The stem should be kept clean to the height of three or four inches above the surface of the soil to permit the ground to be well cultivated, close up to the tree. The general system of pruning consists in retaining a moderate supply of strong, healthy, young shoots from which alone can be expected large fruit. It is best not to head back too much; it would be better to remove the whole branch. Heading back tends to thicken the bush with shoots, so that gathering the fruit is made very difficult; therefore we must bear in mind to thin out so that the hand may be passed between the branches with ease.

The greatest drawback in successful cultivation of the gooseberry is the mildew. Spraying with the following solution just before the buds open in spring, and three times at intervals of three weeks, after the fruit has formed will prevent its spreading.



SEA KALE.

Take of sulphide of potasium,(Liver of sulphur) ¾ oz. to five gallons of water; apply with a fine spray, such as the Nixon or Cyclone Nozzle.

Experiments were made with the above solution at this station last season, with good results.

Notes on Varieties of the Gooseberry.

Americana.—Branches erect. Fruit small, color pink, smooth, productive.

America.—Branches spreading. Fruit large, slightly hairy, light green, tinged with yellow, moderately productive.

Angler.—Branches erect, and spreading. Fruit large, oblong, downy, light green, thin skinned, of good flavor.

Britania.—Branches spreading, somewhat pendulous. Fruit red to yellowish green, of medium size.

Broom Girl.—Branches somewhat erect. Fruit large, slightly hairy, oval. Bush a strong grower.

Crown Bob.—Branches pendulous. Fruit large, round to oblong, hairy, red mixed with green near the stalk, bright red towards the opposite end, thin-skinned, and of good flavor; so far is mildew proof.

Downing.—Branches erect, of medium size, oval to round, grayish green, so far, mildew proof.

Gunner.—Branches erect, of strong growth, fruit large, oblong to oval, slightly hairy, free from mildew.

Green Gage.—Branches erect. Fruit of medium size, ovate, smooth, light green, rather thick skinned, rich, very sugary, an excellent producer.

Golden Chain.—Branches erect, armed with strong prickles. Fruit of medium size, light green tinged with yellow.

Industry.—Branches somewhat pendulous. Fruit large, oval, very productive, free from mildew, and one of the best.

Lobster.—Branches spreading. Fruit small, hairy, dark red. Bush a weak grower.

Major Hibert.—Branches erect and spreading. Fruit a good medium size, oblong, smooth, light green tinged with red. Produces well. Bush a vigorous grower.

Oregon Champion.—Branches spreading. Fruit of medium size, light green, very productive, and free from mildew.

Overall.—Branches erect. Fruit round, very hairy, small, free from mildew.

Prince Regent.—Branches erect. Fruit oblong, smooth, yellowish green, few prickles; a good producer; bush a strong grower.

Rigby's Honey-Moon.—Branches erect, fruit medium size, smooth; bush strong grower; mildews very badly; if protected from the mildew, is very productive.

Sir John.—Branches erect, fruit large, oblong, hairy, yellowish green; free from mildew.

Shadwick's Sportsman.—Branches erect, fruit medium in size, hairy; wood very thickly set with prickles; affected slightly with mildew.

Taylor's Bellerophone.—Branches erect, fruit large; grayish green tinted with yellow.

Violette Oval.—Branches spreading, fruit medium, oval, hairy, bright red, thick skinned, rich.

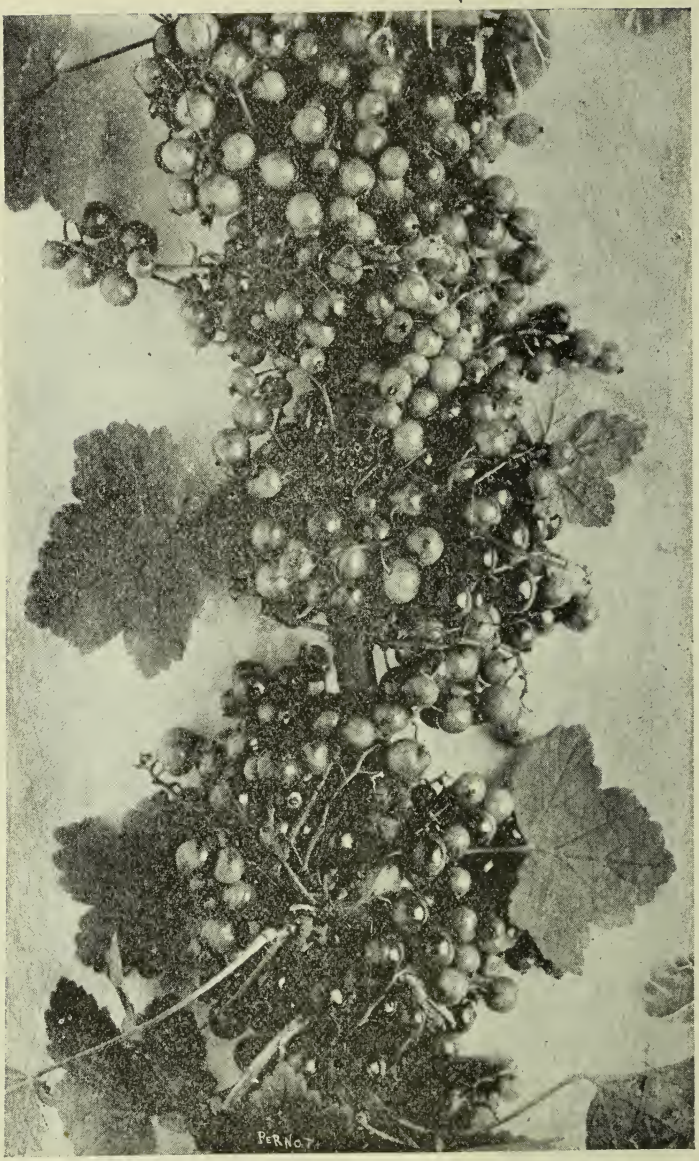
Watson's Tree.—Branches erect, fruit small, light green. This variety was received from Powell & Cushing, American Forks Utah. It is sent out as a very large berry, but as yet it has failed to come up to what is claimed for it. It is probable that by good cultivation it will improve.

Whitesmith.—Branches erect, fruit somewhat above the average size, roundish oval, yellowish white, downy, flavor excellent.

	VARIETY.	SOURCE.	Date of Blooming.	Date of Ripening.	Length of fruit.	Width of fruit.
1	Americanna	Unknown	4 5	7 12	⅜ in.	½ in
2	America	F. Gillet	4 6	7 11	1¼	⅞
3	Britania	"	4 8	7 27	¾ to ⅞	¾ to ⅞
4	Crown Bob	"	4 4	7 12	1⅛	⅞
5	Gunner	"	4 5	7 9	1 to 1⅛	1 to 1⅛
6	Downing	"	4 2	7 12	¾ to ⅞	⅝ to 3-4
7	Golden Chain	"	4 8	7 20	1 to 1¼	3-4 to ⅞
8	Green Gage	"	4 2	7 19	1 to 1⅛	
9	Hero	Salem	4 8	8 6	⅞	⅝ to 3-4
10	Industry	Unknown	4 8	7 12	1 to 1⅛	1
11	Merry Monarch	F. Gillet	4 10	8 6	⅞ to 1	⅝ to 3-4
12	Major Hibert	"	4 8	8 20	1 to 1⅛	⅝ to 3-4
13	Oregon Champion	O. Dick	4 6	7 8	¾ to ⅞	3-4
14	Overall	F. Gillet	4 10	7 19	⅞	3-4
15	Prince Regent	"	4 8	7 20	1⅛ to 1¼	3-4 to ⅞
16	Rockwood	"	4 8	7 11	⅞ to 1	3-4 to ⅞
17	Smith's Improved	"	4 5	7 10	¾	⅝
18	Sir John	"	4 6	7 12	⅞ to 1	3-4 to ⅞
19	Shadwick's sprts'mn	"	4 6	7 8	⅞	3-4
20	Taylor's Bellerphone	"	4 5	7 10	1⅛ to 1¼	⅞
21	Violette Oblongue	"	4 1	7 12	¾ to ⅞	⅝
22	Freedom	"	4 6	7 23	1⅛ to 1¼	3-4 to ⅞
23	Rouge longue Clerir	"	4 9	7 23	¾	3-4
24	Angler	"	4 6	7 10	1 to 1⅛	⅞

Propagation and Pruning of Currants.

The rules for the propagation of the gooseberry, may be applied to the currant. For the purpose of making well formed bushes the cuttings should be fifteen inches long, and all buds carefully taken out, excepting the three at the upper end. The cuttings should then be inserted into the soil six inches; there will then be left from four to five inches of clean stem between the surface of the soil and the first branches. If the cuttings are planted in the fall, the three buds that are left will each make a growth of at least eight or ten inches during the following summer. At the fall pruning these shoots should be cut back to two buds each; from these, two more shoots will be formed the next season, thus forming a bush of six branches. These branches should all be cut back at the winter pruning, so as to leave them from four to six inches long, being always careful to cut back to an outward bud. Each terminal shoot should be cut back, at the winter pruning, until the required height is attained, which need not



THE ABOVE PLATE SHOWS THE FRUITING OF THE CURRANT WHEN TREATED AS IN CUT NO. 2.

exceed three feet. If the soil is rich and the bushes make strong growth they may be permitted to grow to a height of four feet. All laterals that are thrown out from each main branch should be cut back to two buds, at the winter pruning. It will be found when the laterals are treated in this way, that fruit spurs will be formed throughout the whole length of the main branch. The object in cutting to a bud pointing outward, is to encourage the bush to form an outward growth. Under this treatment, work among the bushes will be found much more convenient, and better fruit will be produced. There will be an abundance of leaves and laterals formed each year, to shade the fruit from the direct rays of the sun; thus the gathering of the fruit will be made much easier, and a better appearance given to the plants.

The accompaning cut (No. 2) shows the manner of pruning and the position of the fruit buds on the main branch.

Cut No. 3 represents a branch of the currant in its natural state, with but few fruit spurs. It will be readily seen that the plant has to produce a great amount of wood which should go to the production of fruit, if pruned as in cut No. 2.

This system of cultivation has been used at this station, and has proved very successful. It will be understood that the system referred to above, does not apply to the treatment of the Black Currant. It is practiced only with the white and the red varieties. The fruit of the Black Currant is produced on the one year old wood, and consequently it must not be spur-pruned. Simply thin out all wood that has already fruited and leave the young wood for the production of fruit the following season. This treatment encourages it to produce a strong growth of young wood each year.

Notes on Currants.

Fay's Prolific.—Color dark red; produces large clusters; is less acid than the Cherry. The only objection to it, is that it produces a large number of seeds which injures it for preserving.

Cherry.—Color dark red; very large; the bush makes a strong growth; is very productive, and of good quality.

Red Dutch. Color dark red; this variety is well known, but has been superseded by the larger varieties; but for preserving purposes, it is valuable.

White Grape. This is a very large variety, the largest of the white. The habit of the bush is to spread. It makes a strong growth.

Yellow Transparent. Color yellowish white; of excellent quality; good for table use, and for preserving.

La Fertile. Color, whitish yellow; acid to sub-acid in flavor; many seeded; small clusters; large; productive. Bush a free grower.

Victoria. Color, bright red; clusters of medium size. Fruit hangs a long time on bush. Its buds do not commence to grow so early as other varieties by two weeks, thus protecting it from late frost. The bush is not quite so strong, resembling the Cherry currant in growth.

La Versaillaise. In all respects the same as the Cherry; produces large clusters; and is very productive and valuable.



CUT NO. 2—CURRANT PROPERLY PRUNED.



CUT NO. 3—NATURAL GROWTH OF THE CURRANT

Notes on Blackberries.

Agawan.—Fruit of medium size; melting; does not stand drought well; plant of medium growth.

Evergreen.—This is a very strong growing variety; very prolific; with large glossy black fruit; seeds large; an excellent berry for market purposes.

Erie.—Fruit large; of good quality; berry firm and rich; plant makes a vigorous growth.

Early Harvest.—Fruit of medium size; an early variety; is very hardy; plant of medium growth.

Taylor's White Delaware.—Fruit large, of fair quality. Not productive with us this season. Color of the wood, light green, shading to red; made a vigorous growth.

Synder.—Fruit medium, to large; productive, and of good quality.

Kittanny.—Plant, a strong grower; berry, large and of good quality; firm, a good market variety.

Notes on Raspberries.

Crimson Beauty.—Fruit large, bright scarlet, round to oblong; comes in with the Turner; is of good flavor; moderately firm and productive.

Cuthbert.—Fruit, bright red, firm, juicy, of excellent quality; canes, strong growers; the best all around variety tested at this station, both for market and home use.

Early Prolific.—Fruit scarlet, obtuse, conical, soft, good flavor; good for home use, or a near market.

Gregg.—Fruit of medium size, quite firm; plant a vigorous grower; a good variety of the Black Cap family.

Hansell.—Fruit medium to large; color, crimson; firm; good flavor; canes vigorous; hardy; an excellent early variety.

Souhegan.—Fruit somewhat resembles the Gregg; both varieties come in together.

Turner.—Fruit a bright scarlet; soft; of good flavor; late. Not so productive as Cuthbert; valuable for home use and near market.

Marlboro.—Fruit of good quality, but not productive with us.

For early use we would recommend Hansell. For main crop the Cuthbert. The Wine-berry does not come up to the standard in many ways. The bush is of strong growth, is very prolific and fruit highly colored, but its peculiar flavor is against it. For ornamental purposes it is very attractive.

VARIETIES.	Received from	Date of planting.	Age of plants.	Date of vegetating in March.	Date of blooming in May.	Date of first ripe fruit.	Date of 1st picking	Date of last picking.	Length in inches.	Diameter in inches	Quality Scale.	Firmness Scale.	Market value Scale.	Home value Scale.	Vigor Scale.	Hardiness Scale.	Weight of ten berries in ounces.
1 Souhegan	Unknwn	Mr. '91	2yrs	15	18	Jne 24	Jne 29	Jly 14	⅜	⅝	8	8	8	8	9	9	.48
2 Gregg	Meehan.	"	2yrs	15	17	24	29	14	⅜	½	7	8	8	8	9	10	.59
3 Cuthbert	Meserve	"	2yrs	17	24	27	Jly 1	Ag 8	⅝	¾	10	9	10	10	9	10	1.
4 Early Prolific	Meehan.	"	2yrs	20	20	23	2	8	½	⅝	8	9	8	8	8	9	.42
5 Hansell	Dick	"	2yrs	15	21	10	Jne 16	Jly 31	½	⅝	8	10	8	8	8	9	.45
6 Turner	Dick	"	2yrs	15	20	Jly 1	Jly 1	Ag 22	½	⅝	9	8	9	9	8	9	.55
7 Marlboro	Dick	Mr. '90	3yrs	17	28	Jne 28	2	Jly 25	⅝	½	7	9	8	8	8	8	.40
8 Crims'n Bea'ty	Meehan	Mr. '91	2yrs	17	22	Jly 1	7	Ag 24	½	⅝	8	9	9	9	8	9	.71
9 Wine Berry	Childs			15			29								9	9	.30

Pruning

Cut (No. 4) represents an apple tree from which the photograph was taken before the operation of pruning had been commenced. These cuts are given for the purpose of illustrating the method of pruning orchard trees.

In the pruning large neglected trees, to bring them into vigor and fruitfulness they should not be headed back in such a manner as to divest them of all bearing wood. When this is the case, it gives rise to a greater production of young wood.



CUT NO. 4.—APPLE TREE BEFORE PRUNING.

Consequently they form a great many more branches than are needed, and in a short time they become even worse than before. This work is a loss of time. Such trees should only have their branches thinned out in such a way that light and air can be admitted to all its parts in proportion. The higher straggling branches should be taken out so that the trees can be brought to a symmetrical form, as shown in cut (No. 5.)

The time for pruning is from the fall of the leaf until the buds commence to burst in spring. Never use the ax in the operation; the saw is preferable.



CUT NO. 5.—APPLE TREE PROPERLY PRUNED.

Notes on Peaches.

In 1889 the station purchased forty varieties of young peach trees, three of each kind. They were planted in the experiment plot, east of the College Building; the ground sloping gently toward the east. They were not received until late in the spring, being unavoidably detained in transit, by the washout in the Cow Creek Canyon, on the Southern Pacific railroad.

In consequence of this delay, they were not in good condition, but all varieties were planted and afterward were severely cut back. Some began to grow at once, while others, made no growth until midsummer. But few of them made sufficiently early growth to enable them to ripen their wood. In the Fall of 1890, growth was kept up until cut by frost. The result was that a few trees died. Most of those that remained, were so severely affected by "Curl leaf" in the spring of 1891, that they were again checked in growth; but after the beginning of June, they made rapid growth. The wood was not well matured. They continued to grow very rapidly until again checked by frost. The winter of 1891--92 was very mild up to the time the buds began to expand. At this time four very sharp frosts came, which killed the bloom buds, causing a complete failure of the peach crop. Nearly all the varieties were injured by "Curl leaf" the following spring. The fall of 1892, has been very favorable to the growth of trees. The wood is well ripened, and better results may be expected the coming year. Below will be found a list of varieties affected by "curl leaf" also of those that died and of those that have been free from "curl leaf."

List of varieties of peaches that have been affected by "curl leaf" for three seasons in succession.

Amelia, Alexander, Austin Cling, Boston, Bishop's Early, Burnice, Columbia, Comet, Elison, Early Crawford, Globe, Indian Blood, Lovell, Governor Briggs, Mother Porter, Oriel, Pallas, Perkins, Reeves' Favorite, Sellers, Susquehanna, Salway, St. John, Wheatland.

Varieties free from "curl leaf" are as follows: Alpha cling, Honest Abe, McKivet Cling, Hardy Tuscany, Ulatas, Clements, Tuscany Cling, and Fisher's late White.

Varieties that have died.

Miss Lola, Miller's Seedling, Salway, Wheatland, Hale's Early, Pansy Paber, May's Choice, and Elberta.

N.B. Salway and Wheatland died during this last summer.

Renovating Old Orchards

For the purpose of determining the best method of renovating old orchards, experiments were begun at this station in 1889, in an orchard situated on the college farm. It had been neglected for years and was practically worthless. The branches were covered with moss, many were dead, while the tops were matted together with water sprouts. The common opinion was that the orchard would better be cut down and a new one planted.

Having set apart two trees which were to be kept as specimens of the

old orchard, the experiment of renovating the remainder of the orchard began.

The first thing done was to thoroughly prune it, thinning out the branches so that none were permitted to cross or to touch another. This admitted the sun light and permitted a free circulation of the air among the branches. The ground was then plowed to a depth of eight inches and permitted to remain in the rough state until spring. As soon as the soil was sufficiently dry to be worked, it was again plowed and thoroughly harrowed. Thus the soil was well pulverized. Through June and July the ground was stirred with the cultivator every two weeks. Under this cultivation the trees made a vigorous growth, during the summer. In the fall of 1890, after the leaves had fallen, the trees were slightly pruned, by removing all the water sprouts. Only a few of the main branches required to be removed.

Cultivation was continued in precisely the same manner as in the previous year, except that the ground around apart of the trees received a liberal supply of stable manure and around the remainder a good supply of wood ashes. The better results were obtained from the use of the stable manure but the whole orchard was greatly improved by the cultivation.

During the winter of 1891-2 all the water sprouts were removed and the main branches carefully pruned, and the same manner of cultivation was carried out as in the previous years. This has proved to be of the greatest benefit to the trees. The varieties of trees in the orchard are as follows: Baldwins, Waxen, Winesap, Spitzenburg, Fall Pippin, and Rambo. The size of the fruit, the color, and the flavor are each very much improved, thus proving that thorough cultivation is essential in securing the best results. The fruit on the uncultivated trees is practically worthless, being small and insipid, the color indicating the impoverished condition of the fruit.

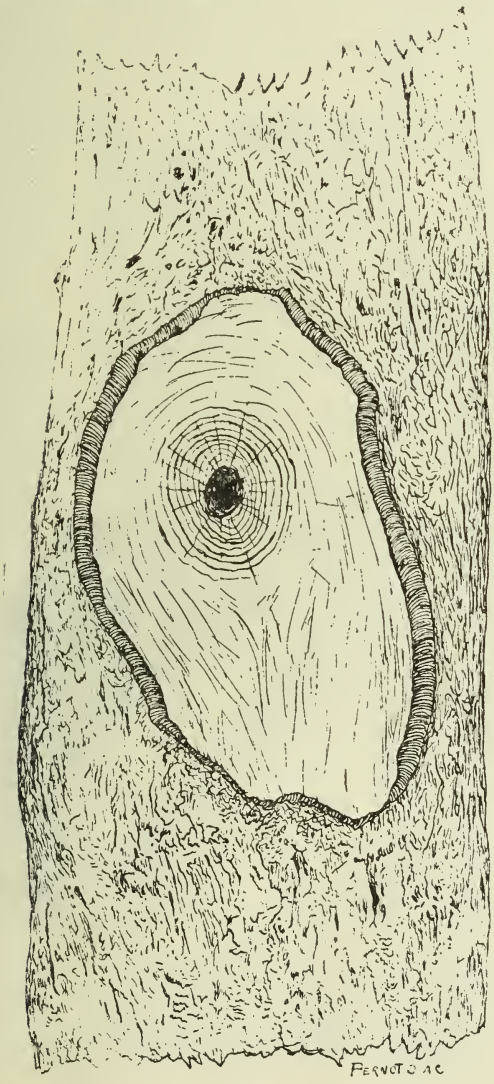
No means have been used to destroy the moss on the trees, yet it has disappeared from those trees under cultivation, but remains upon those which have not been cultivated. This can only be attributed to the admission of the sun's rays and the free circulation of the air among the branches.

Owing to the long continued dry summers in the Willamette valley cropping the ground in an orchard should not be attempted after the trees are five or six years old. Better results will be had after this time by clean cultivation. The frequent cultivation (every two weeks) keeps the ground thoroughly pulverized, thus enabling the air to circulate freely between the particles of the soil. In this way the soil is kept moist by the moisture absorbed from the air.

The cultivation should not be continued later than the first week in August. If it is continued later the trees are stimulated to make growth too late in the fall, and the wood does not ripen sufficiently to withstand the frost of winter. The thorough ripening of the wood should be encouraged, thus preventing the winter-killing.

In pruning old trees, frequently large branches must be removed. When this is the case, care must be taken to have the cut made close up to the stem. The wounded surface must be carefully smoothed, so that the

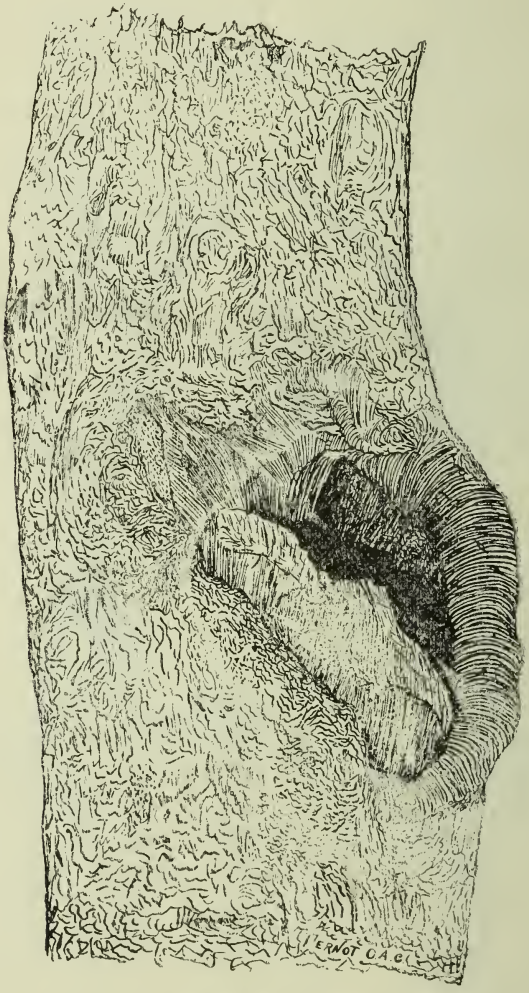
new wood in its growth can rapidly cover the wound. The accompanying engraving (No. 6,) represents the manner in which a branch has been properly removed. It will be readily seen how the new growth has commenced



CUT NO. 6.—EFFECT OF PROPER PRUNING.

to cover the wound. Such a wound would be permanently healed within a few years and the vital energy of the tree would not be affected.

Engraving (No. 7.) represents the wound made by cutting the branch about three inches from the body of the tree. In this case the wound could not be healed before that part of the branch extending beyond the main stem of the tree began to decay. The decay of this protruding branch has extended into the body of the tree causing it to rot, thus causing a permanent wound which continues to sap the vitality of the tree.



CUT NO. 7.—EFFECT OF IMPROPER PRUNING

Donations to Horticultural Department During 1892.

J. S. S. POWELL, Beaver Creek, Philomath. Seedling gooseberry, and two scions of Prunnus Pisardii.

J. L. CHILDS, Three gladiolus bulbs.

G. G. GILBERTSON, one p'k't onion seed.

H. BISHOP, Chelmsford, England. p'k't onion seed.

C. P. BAUER, Judsonia, Ark. Collection of thirteen varieties of strawberries.

D. M. FERRY & Co., Detroit, Mich. Two packages Cauliflower seed.

J. BRIGGS, Albany, Or. Three Champion Black and Fays Prolific Red Currants; two trees of Bienheim Orange Apple. Carnations—Mount Hood, Kearns, Miss Whitehead, Miss Monteith, Silver Spray, Ralph Connor; four gladiolus bulbs; fifteen varieties polyanthus; three cedars; three laburnums; three pyracanthus.

List of Orchard Fruits Planted on Trial Grounds.

Apples.

Autumn Sweet,
Abram,
Bethlemite,
Bienigheimer,
Bailey's Sweet,
Bottle Greening,
Charlottenthaler,
Colvert,
Canada Red,
Canada Reinette,
Delaware Red,
Dutch Migonie,
Domine,
Winesap,
Early Strawberry,
Evart,
Fall Wine Apple,
Fall Janettin,
Fallow Water,
Fameuse,
Grimes Golden,
Green Sweet,
Gann,
Gravenstein,
Golden Sweet,
Haas,
Hydes Keeper,
Holland Beauty,
Holland Pippin,
Janeting,
Jeartts Fine Red,
King of Tompkin's Co.
Keswick Codlin,
Longfellow,
Limber Twig,
May of Myers,
McMahon's White,
Mann,
Maiden's Blush,
Munson's Sweet,
Montreal Beauty
Melon Sweet,
Missouri Pippin,
Melon,
Martha,
Montreal,
Northern Spy,
Oldenburg,
Ortly,
Pumpkin Russett,
Paradise Sweet,
Pewaukee,
Rambo,
Red Astracan,
Rock Pippin,
Romanite,
Rome Beauty,
Rhode Island Greening,
Rawles,
Rockberry Russett,
Red Golden Pippin,
St. Lawrence,
Shanasess,
Scott's Winter,
Standard,
Summer Queen,
Saloine,
Stark,
Sweet Bough,
Soulard,
Steel's Red,
Tetofsky,
Trumble's Sweeting,
Twenty Ounce,
Talman Sweet,
Taylor's,
Vanswick's Sweet,
White's Pippin,
Whitney's 20 Ounce,
Wallbridge,
Wolf River,
Western Beauty,
Wagner,
Wealthy,
York Imperial,
Yellow Transparent,

Total 86.

Pears.

Burre d'Anjou
Burre d'Gifford,
Burre d'Clarigeau,
Burre d'Easter,
Belle Lucrative,
Comet,
Clapp's Favorite,
Cole's Seedling,
Dutchesse d'Angouleme
Dutchesse of Bordoux,
Goodale,
Garber,
Grand Isle,
Idaho,
Kieffer's Hybrid,
Knight's Seedling,
Louise Bonne de Jersey,
La Conte,
Lawrence,
Little Gem,
Madeline,
Osborn Summer,
P. Barry,
President,
Souvenier de Congress,
Sickle,
Vicar of Winksfield,
White Doyenne
Winter Nellis,

Total 29.

Cherries.

Black Republican,
Black Tartarian,
Bing,
Coe's Transparent,
Centennial,
Elton,
Early Purple Guigne,
Gov. Wood,
Great Bigarreau,
Ida,
Kentish,
Knight's Early Black,
Lewelling,
Late Duke,
Lawrence,
Lincoln,
Lieb,
Monterey,
May Duke,
Major Francis,
Napoleon Bigarreau,
Olivet,
Royal Ann,
Rockport Bigarreau,
Toronto,
Willamette,
Yellow Spanish,

Total 27.

Plums.

Bradshaw,	Ickworth,	Spaulding,
Botan or Abundance,	Imperial Gage,	Smith's Orleans.
Blackman,	Kelsey or Japan,	Saratoga,
Chalot,	Marianna,	Shannon,
Columbia,	McLaughlin,	Semiana,
Coe's Golden Drop,	Orange,	Washington,
Forest Rose,	Purple Damson,	Yellow Japan,
Goliath,	Peach Plum,	Yellow Magnum Bonum,
Green Gage,	Quackenboss,	Yellow Egg,
Ives' Seedling,	Satsuma or Blood,	Total 29.

Prunes.

Silver, German, Petite, Italian.

Grapes.

August Giant,	Improved Deleware,	Rogers' Hybrid,
Brighton,	Jewel,	R Nox,
Concord Muscat,	Moyer,	Green Mountain,
Catawba,	Moor's Diamond,	Ulster's Prolific,
Delaware,	Nectar,	Witt,
Early Victor,	Niagara,	Wonder,
Faith,	Oneida,	Wilding,
Golden Gem,	Pocklington,	Warden,
Golden,	Purity,	Wilder,
Herbert,	Peabody,	Wyoming Red,
Hartford Prolific,	Pearless,	Woodruff Red. Total 23.

Crab Apples.

Hyslop, Lewelling, Siberian, Transcendant.

Apricots.

Moor Park. Persian Royal, Peach

Almonds.—Soft Shell. **Nectarines.**—Boston, and Violette.

Meteorological Summary.

For Seven Months, Commencing March 1st and Ending Sept. 30th, 1892. Observations taken at the State Agricultural College, Corvallis, Oregon, by JOHN FULTON, B. S.

Average Monthly Temperature of the Soil.

	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.
At the depth of 2 inches	40°	47.5°	56°	64°	[illegible]	66°	64.5°
" " " 6 "	47.5	50.5	56°	62.5	66°	68.2	61.8°
" " " 12 "	47	49.6	56.8	61.5	65.8	68°	63.8°
" " " 24 "	48.5	49.9	54.5	59.4	63.6	66°	65°
" " " 36 "	48.6	50	53.5	58.	62.1	65°	64°
" " " 48 "	48.9	50.3	52.5	56.9	60.2	63°	63.5
Highest Solar Maximum	120°	130°	141°	142°	139°	145°	141°
Date	19th.	21st.	[illegible]	16th.	8th.	18th	6 th
Lowest Solar Maximum	70°	65°	95°	59°	119°	126°	75°
Date	17th.	5th.	30th.	7th.	15th	23rd	22nd
Highest Terrestrial Min.	55°	.....	77°	50°	56°	58°	59°
Date	7th.		29th.	16th.	19th	9th	13th
Lowest Terrestrial Min.	22°	.....	32°	33°	42°	41°	33°
Date	2nd		7th.	21st.	9th	14th	20th
Average Solar Maxim	106.9	115°	127.2°	135°	133.4°	134°	119.6°
Average Terrestrial Min	.....	.....	39.4	42.5	48.7	44.1	45.2°
Highest Thermometer	60°	70°	84°	96°	86°	93°	90°
Date	15th.	20th,	24th.	27th	8th	18th	8th
Lowest Thermometer	29°	32°	33°	39°	38°	43°	34°
Date	3rd.	25th.	2nd.	9th	19th	16th	21st
Average Thermometer		45°	56.7°	62.7	64.5	62.2	62.5°
Rainfall	3.20in.	4.65 in.	.45 in.	.61 in,	.45 in.	trace.	1.68 in.
Greatest Rainfall 24 hrs.	1.00in.	.80 in.	.25 in.	.16 in.	.15 in.	.....	.80 in.
Date	28th	24th.	9th.	9th.	15th		22nd
Prevailing Wind	S. W.	S. W.	West.	W. & N.	North	W. N.	N. S. W.
Total movem'nt of Wind	5822 miles	5332 mil's	5580 mil's	6193 mil's	6428 mil's	6489m	4223 mi.

Dates of frost.—March 1st, 2d, 3d, 5th, and 10th. April 11th, 18th, and 25th. May, very light frost on the 18th.

Oregon Agricultural

Experiment Station

Bulletin No. 23. February, 1893.

Experiments in the Culture

of the

SUGAR BEET IN OREGON.

By G. W. SHAW.

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

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BAKER
JEFFERSON
CROOK
DESCHUTES
KLAMATH
LAKE
HARNEY
MALHEUR
15.12 (1)
13.55 (1)
14.37 (11)
14.30 (11)
14.38 (5)
14.19 (7)
14.13 (7)
14.40 (29)
14.46 (5)
14.28 (51)
20.20 (1)
17.89 (12)
INDIAN RESERVATION
WARM SPRINGS
MALHEUR
HARNEY
KLAMATH
SUMMER LAKE
LAKE ALBERT
IRON MT.
PERNOT OAK

THE SUGAR BEET IN OREGON.

By G. W. SHAW, A. M.

In accordance with the plan set forth in Bulletin No. 17, published by this Station in February, 1892, experiments as to the possibility of raising beets for the manufacture of sugar in Oregon have been continued during the past year, and the results, together with other points of interest and importance, are set forth in this bulletin.

The reasons for undertaking the investigations may be stated as follows: The United States consumes annually about 2,000,000 tons of sugar, and the demand is constantly increasing. At present the American people are consuming annually 59 lbs per capita of imported sugar and only 9 lbs per capita of American sugar. To pay for this imported sugar our country has sent to Europe during the last few years about $100,000,000 annually, and this has been done notwithstanding there are areas within the United States as well, if not better, adapted to sugar production than any in Europe. The Federal government, recognizing that we should be independent of Europe so far as possible and the more to encourage home production, on Oct. 1, 1890 abolished the duty on sugar and in lieu thereof offered a bounty of two cents per pound for all domestic sugar testing 90° or more (1½ cts for all testing between 80° and 90°) produced until July 1, 1905. If this country produced her own sugar under this law there would be a bounty of $50,000,000, paid to those engaged in the business in addition to saving to the nation the $100,000,000, now sent to foreign countries to satisfy the sweet tastes of the American people. This would certainly go some distance in satisfying the cry of many farmers for "more money".

The Experiment Stations of many States have been investigating this subject for the past few years and many thousand analyses of American raised beets have been made and there is no longer any doubt but that there are large areas in this country adapted to sugar beet culture. California, Utah, and Nebraska are already reaping the reward of the government bounty and the benefits of home production, and companies are being formed in other states where the conditions seem to be favorable. During the year ending June 3rd, 1892, the government paid for the production of beet sugar the following bounties, California, $163,511; Nebraska, $54,690; Utah, $21,898.

The question comes forcibly to us, can Oregon stand in the line of sugar

producing states? Can she not reap the rewards of this bounty? One of the heaviest sugar dealers in Portland estimates that that city alone consumes and distributes over 25,000,000 pounds of sugar per annum. In view of what has been said it certainly is well for us to ask why not keep a portion or all of the money paid for this sugar at home and also receive the benefit of the federal bounty, gaining also the other advantages to be derived from this culture, such as building up prosperous communities around the factory, giving better market for other home productions, and encouraging the farmer to adopt scientific methods of cultivation. This manner of work would of a necessity extend to other industries until its influence would be felt in all lines of agricultural pursuits.

If the soil and climate of Oregon are favorable to the production of good sugar beets then there is a new and profitable industry possible for our farmers and capitalists, and according to Mr. Paddock in his speech before the U. S. Senate, the beet sugar industry is more important than any twenty others in this country. It was to seek an answer to this question that the experiments were conducted.

The report of the investigations of 1891, which was published in February of last year, contained a full account of the relation of Oregon's climate to this culture, but since the edition of the bulletin above named was exhausted very soon after publication and as there is still a demand for the bulletin a review of the work of that year is incorporated in this report, which is therefore separated into three portions; Part I having to do with the results of 1891—1892; Part II with the results of 1892—1893; and Part III with conclusion and matters of general interest connected with the subject.

In the back of the bulletin is printed a complete table of the analysis of all beets which have been received at the Experiment Station in a suitable condition. Analyses numbered from 1 to 96 were made during the season of 1891—1892, and those from 96 to 161 during the season 1892—1893.

Following this table will also be found another showing the analyses of Oregon grown beets sent to Washington D. C. to the U. S. department of Agriculture. In the front of this bulletin will be found a map upon which the places where beets containing over 14 per cent sugar have been grown, and also the average of all the analyses for each county.

Part I.

The beet is a hardy biennial plant indigenous to Southern Europe and more recently introduced into Canada and the United States, and for its successful production depends mostly upon climate, soil and cultivation. To determine the best methods of cultivation as suited to our local conditions requires cultivation upon a larger scale than was feasible in these investigations besides being a line of work belonging to the Agricultural Department, hence no conclusions are attempted in this direction.

Each year arrangements were made with farmers in different portions of the State to cultivate a small plat of beets, the seed being furnished them

by the Station. Although there was a hearty and ready response to the Station's offer to furnish seed to those who would agree to forward samples for analysis, accompained by a report, —blanks for which were furnished— there were many who never responded to a single inquiry after they had received the seed, notwithstanding the fact that they had expressly agreed to report results. To those whose careful culture of the beets rendered it possible to conduct the experiment so successfully, as well as to the assistant Chemist, our heartiest thanks are hereby expressed.

In addition to those not reporting in any way there were some who seemed to think that no report was desired or expected if the crop was not successful and the results were not sufficiently large to "boom" the country. The Station was in pursuit of the facts in the case, and if the State or a county cannot produce good beets it is just as important for the public to know it, that failure may be avoided, as it is if the conditions, prove favorable. The Station does not exist to "boom" any portion of the State, but is in search of *bare facts*, be they favorable or unfavorable.

Seed and Cultivation.—The seeds used in the investigation were imported varieties, and the following directions for cultivation, which were taken from the most competent authorities in this country and Europe, were sent out with each package of seeds,

Method of Growing Sugar Beets to be followed by those taking part in the Co-operative Experiments with Sugar Beets in Oregon.

Soil.—This should, where possible, be a light loam, preferably containing some lime. The land should be well drained. The beet gets the greater part of its food from the ground at a depth of 8 to 12 inches. Hence freedom from excess of water is necessary.

Preparation of Land.—The land selected should have been plowed the fall before planting of seed. As soon as it can be properly worked in the spring the land should be plowed again, this time to the depth of 12 inches. Allow to lie until about one week before the time of seeding. Then plow once more to the depth of 4 to 5 inches, and work the soil up into a fine and *light* condition (i. e., do not pack it down with a drag). After allowing land to lie 5 to 7 days plant the seed. The object of allowing the land to lie is that sufficient moisture may be drawn from below for the germination of the plant, and that the land may be warmed by the sun, after pulverization. No manure should be applied unless in the shape of well rotted compost put on in the fall. The land on which the beets are to be grown should be measured approximately, and enough ground planted so that it will be possible to take the eightieth of an acre from the plot without including any *outside* rows. In ordinary soil the rows should be eighteen inches apart. In very rich less; and in poor soil more than that distance apart: The conditions should be such that the beets can not attain a greater weight than two pounds each. The seed should be planted one-half to three-quarters of an inch deep, and about 20 pounds of seed to the acre. Plant, where possible, in April.

Cultivation.—This should be thorough, and should begin as soon as the plants show in the row. When the beets have put out four leaves, thin them out so as to leave the plant standing about 4 to 6 inches (not farther) apart in the row. The weeds should be kept down and the ground well stir-

red. It should be remembered that a beet which grows up out of the ground is worthless for sugar, also that the beets must not attain to a weight greater than two pounds apiece, and must be smooth and tapering in shape.

CLIMATE.—In the matter of climate Oregon seems well suited to the sugar beet as is shown by the following tables and the chart on the opposite page. Temperature curves are given for the Willamette Valley and Eastern Oregon simply as a matter of convenience, the curves for Southern Oregon running very close to that of the Eastern portion of the State.

The season for the growth of beets may be divided into three periods—that of germinating; that of plant formation; and that of sugar storing. The following is a comparative table showing the temperature averages for Germany and certain parts of Oregon during these periods.

TEMPERATURE TABLE FOR PERIODS OF GROWTH,

Periods of Growth	Av. Temp. Foreign.	Av. Temp. East. Org'n	Av. Temp. Willam. Val	Av. Temp. South'rn Or
First.....	49.1	56.0	52,5	53.1
Second.....	63.3	65.0	64.4	64,5
Third.....	56.3	64.4	63.3	54.8

For charts showing the average monthly temperature for the season of 1891—1892, and its relation to the normal the reader is referred to page 10.

As to rainfall the average amount does not differ much from that of beet growing regions of other countries, yet it is not so evenly distributed. It will be true with this as with all crops in the northwest that the *seasonal* precipitation is that to which attention should be directed, for in Oregon, as in California, nearly all the precipitation takes place during the "rainy season." To show this the following table is used.

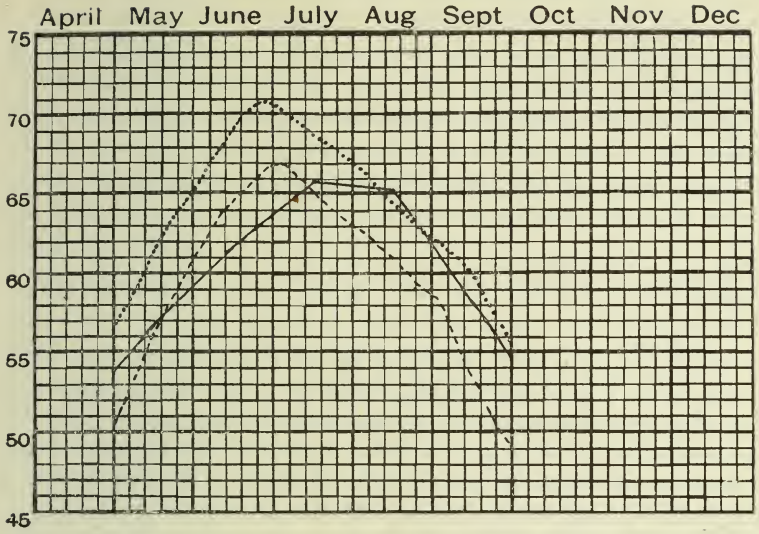
SEASONAL PRECIPITATION TABLE. †

LOCALITY.	SPRING. Mar-May	SUMMER. Jun-Aug	AUTUMN. Sep-Nov	WINTER Dec-Feb	Years Obs'v
LaGrande, Eastern Oregon	4.10	2.26	2,38	15.81	2
The Dalles, Central Oreg'n	2,93	.88	3.98	8.50	13
Albany, Willamette Valley	10.07	2.43	9.75	22.76	8
Roseburg, Southern Oregon	8.22	1.79*	8.00	17.60	10
Newport, Coast Region.....	11.60	8 16	10.72	34.50	2
Ashland, Southern Oregon.	4.79	1.61	4.90	11.63	4
Lakeview, Lake Region.....	4.32	3.09	3.18	6.79	3

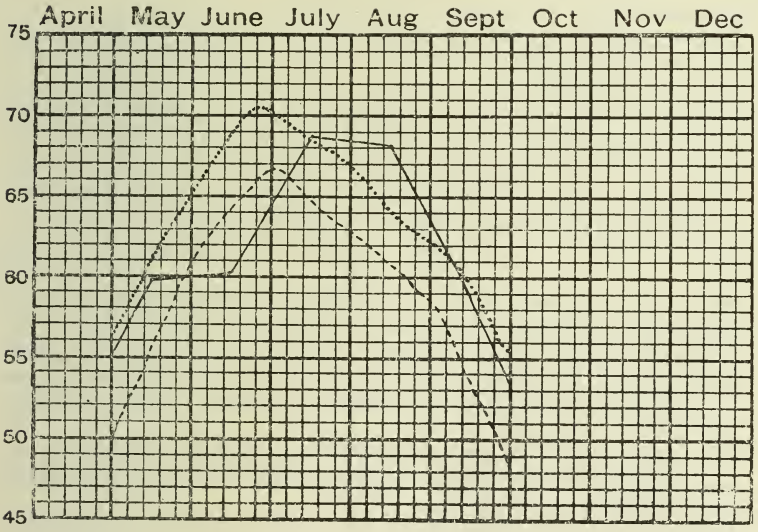
*For two months only. †Compiled from State Weather Bureau data.

SOIL.—"Vilmorin considers that any good soil that will grow wheat and has an arable stratum of 12 to 15 inches will be well suited to this culture." There is little more that need be said concerning this further than that new ground should never be used, and that a stiff clay soil is unfavorable. While soils carrying alkali do not materially affect the amount of sugar in the beet, its presence in the soil so affects the sugar stored in the beet as to render it difficult of crystallization, hence beets raised on such soil cannot be used for the manufacture of sugar.

Comparative Temperature Charts.



France .....
Germany - - - - - -
Willamette Valley———



France .....
Germany - - - - -
Eastern Oregon ———

RESULTS.—The analyses made at the Station during the season of 1891–1892 may be summarized as follows:—

TABLE SHOWING COUNTY AVERAGES FOR 1891.

County	No.	Sugar.	Purity.
Benton	39	12.30	74.12
Clackamas	7	14.55	77.30
Columbia	1	13.74	79.42
Douglas	9	12.99	73.45
Jackson	3	18.93	80.99
Lane	16	14.32	79.95
Linn	5	13.54	79.91
Marion	1	15.99	78.38
Polk	1	14.72	78.08
Union	3	15.84	79.89
Washington	11	13.96	78.79
Yamhill	1	10.73	76.64
Average		14.13	78.08

For manufacturing purposes beets should contain not less than 12 per cent sugar; the typical beet weighing about 600 grams,* having 14 per cent sugar and a purity of about 80. An examination of the results reveals that the analyses had a wide range: viz: from 6.77 per cent to 22.44 per cent sugar in the juice. Of the 95 analyses made 8 fell below 10 per cent; 76 showed over 12 per cent and 37 over 14 per cent sugar. An average of 81 analyses for Willamette Valley shows 13.76 per cent sugar and a purity co-efficient of 77.89; the average beet weighing a little over 1¼ pounds, while an average of 10 analyses of beets from Southern Oregon showed 13.38 per cent sugar with a little larger beet. For the entire state the average weight was 608.5* grams; sugar in juice 14.13 per cent; purity 78.08.

YIELD AND COST.—An attempt was made to collect reliable data as to these items, but the reports received were very meagre. The average of all reports concerning yield was 20.5 tons per acre, the extremes being 5.1 and 44.2 tons So far as reports were received the cost of production ranged from 11.25 to 24.18 per acre, some including harvesting and some not, which represented all hand work. This subject is treated more definitely in Part II.

ENEMIES.—There were but few pests reported as troubling the sugar beet. The most to be feared is perhaps, *Monoxia guttulata*,as reported by Prof. F. L. Washburn and described by him in Bulletin No. 14, of this Station.

There was also sent to this Station another insect which was said to be troubling the beets in Clackamas county. This pest known as the "flee beetle" —*Phylotreta decipiens* (Horn) belonging to the family *Halticidæ*—is about ⅛ inch long, and of a black color. They are found on radishes, turnips, potato vines etc. It is not likely that they are a serious enemy to the sugar beet.

The "cut worms" were also reported to have caused considerable damage to the beet in Central Oregon. In fact, they were reported as having in some instances destroyed the entire crop.

Gophers also caused some trouble in Benton county and are said to have shown a decided preference for the sugar beets.

*A gram corresponds approximately to .03528 ounces.

Part II. Experiments of 1892--1893.

PLAN.—As in the experiments of the previous year the beets were raised in different portions of the state, the seed being more generally distributed and more varieties used. From the experiments of the previous year it had become evident that beets containing a high percentage of sugar could be produced, hence in the experiments of 1892—1893 it was sought not only to confirm the results of the preceeding year but also to ascertain something more definite relative to the cost and the yield, and a few points of scientific interest.

For the investigations of 1892 the following varieties were used Desprez, Early Rose, Vilmorin Improved, Klein Wanzlebener and White Imperial all of which are favorite kinds, the first being much used in California. Unfortunately the seed was delayed in reaching us so it could not be distributed to the farmers as early as it should have been to secure the best results. Had the seed reached us in due time it could have been put into the ground in April for at that time there was a favorable time for seeding, but by the time the seed had been distributed cold weather set in and continued till May after which the weather became very dry rendering the conditions for a fair trial very unfavorable. The temperature conditions for the season are indicated on the charts given on the following page, which also give the normal temperature and that for the previous season. The rainfall for the season was below the normal and reports all read "very dry," "extraordinarily dry," "weather very unfavorable." In fact nearly all the beets in the Eastern portion of the state failed to mature, and in many instances the seed failed even to germinate. So far as the season's climate is concerned, then, the experiments were greatly handicapped and we were "in pursuit of knowledge under difficulties".

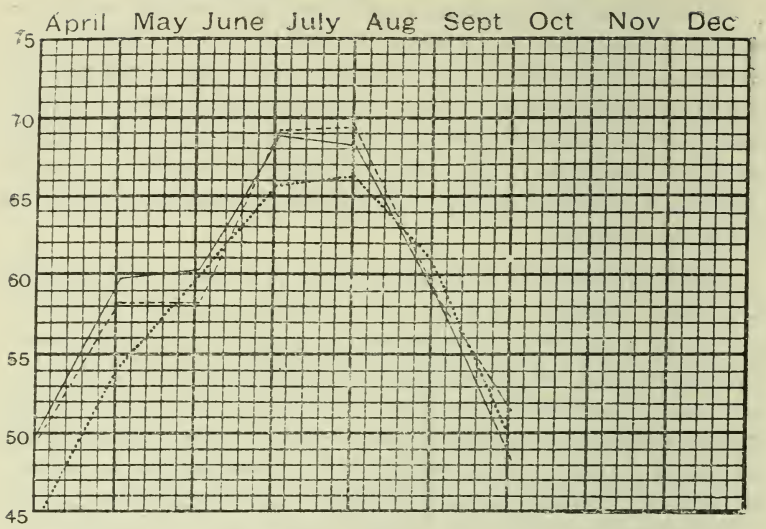
The cultivation for this season was the same as for the previous year except that the rows were placed 20 inches apart.

Owing to the disturbed condition of the experiment the results are doubtless poorer than would have been the case had the season been one of more nearly normal condition. Still the results confirm the conclusions of the previous year that Oregon possesses the conditions necessary for the production of excellent beets for the purpose of beet sugar manufacture.

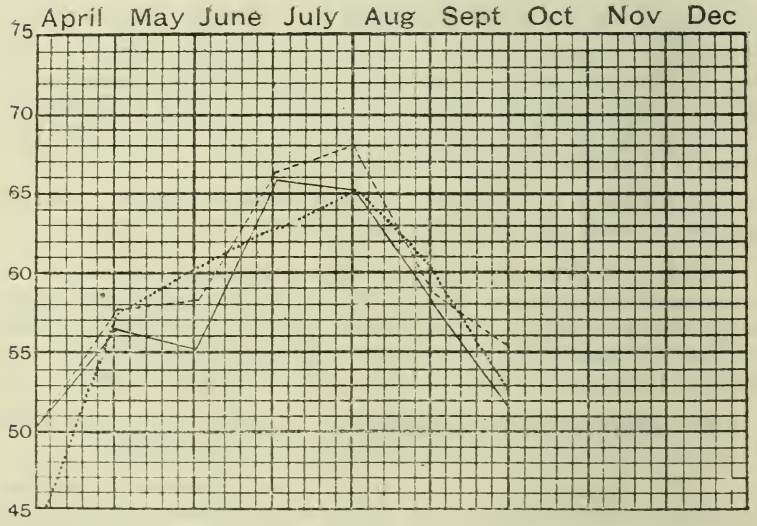
The complete analyses for this season are recorded in the table at the back part of this bulletin being numbered from 96 to 161 inclusive.

In the following table are recorded such cultivation notes as were reported for the above numbers and while they may not be of interest to the general reader, it is hoped they will be of value to those who desire to *study* the matter of sugar beet growing in Oregon.

Comparative Temperature Charts.



Normal for Eastern Oregon ————
Mean " " " 1891 – – – – –
" " " " 1892 . . . . . .



Normal for Willamette Valley————
Mean " " " 1891 – – – – – –
" " " " 1892 . . . . . .

CULTIVATION NOTES FOR 1892--1893.

In the following table is given the amount of cultivation which was given to each sample analyzed so far as reports could be obtained.

Lab. No.	NAME OF GROWER	COUNTY	Av wt of Beets in Pounds.	Per cent Sugar in Juice.	Purity.	Report'd yld tons.	Soil.	Date of Planting	Date of Harvsting	CULTIVATION.
96	E. F. Meisner,	Josephine	392	16.0	74.41	15.2	Gravelly clay	Apr 19	Nov 14	Cult. 3 times, hoed 3 times, irrig'ed 3 times
97	A. J. Thompson,	Clackamas	650	15.2	86.85	9.3	"Shotland,"	May 11	Sept 26	Hoed four times.
98	J. J. Odale,	Union	405	16.1	90.95	....	Drk Sd loam	May 7	.....	Hoed twice.
99	A. J. Goodbrod,	Union	817	23.0	85.50	Enorms	Sandy.	June 12	Sept 27	Pulled weeds once.
101	S. P. Reeder,	Washington	532	18.2	78.68	14.1	Black loam.	May 27	" 26	Cultivated six times.
109	T. E. Hills,	Jackson	783	15.0	84.74	17.4	Granite.	April 20	Oct 11	Irrigated.
110	J. M. Hirsh,	Union	605	17.0	.....	....	Sandy.	.....	.....	.....
117	H. Buxton,	Washington	1045	14.3	88.80	....	Dark loam.	May 16	Oct 21	.....
119	G. R. Woodruff,	Benton	620	9.4	81.70	29.4	Sandy loam.	May 5	Nov 1	Plowed twice, hoed five times.
120	"	"	640	12.9	82.17	18.0	" "	" 5	" 1	" " " " "
121	"	"	776	11.9	82.17	38.0	" "	" 15	" 1	" " " " "
123	W. L. Tower,	Douglas	192	20.6	84.32	8.2	Red loam.	April 22	Oct 29	Plowed twice, hoed twice.
124	J. D Rowell,	Washington	341	19 0	67.80	21 0	Red hill.	May 6	" "	Cultivated four times.
128	B. D. Dyer,	Douglas	291	11.3	79.02	6.7	Granite.	June 1	.....	Hoed twice
129	R. E. Cartwright,	Lane	568	15.1	87.00	30 4	Clay.	May 25	Oct 28	Plowed and hoed once.
130	M Lemmer,	Douglas	458	15.0	84.90	17.4	Sandy loam.	April 15	" 27	Garden.
131	O. P. Pointer,	Washington	538	14.7	71.80	8.1	Clay	May 28	" 31	Hoed twice.
132	M. Snyder,	Linn	617	17.1	73 40	11.7	Sandy loam	April 8	" 29	Plowed once, hoed three times.
133	J. D. Stewart,	Polk	750	18.7	76.60	21.7	Black loam	May 15	" 31	.....
134	Jas Edson,	Yamhill	1416	16.3	77.20	....	" "	" 18	" 27	.....
137	M. O Lownsdale,	Yamhill	1050	12.5	78.60	47.0	Red hill	" 20	" 20	Subsoiled to 19 in, cult. twice, hoed 4 times,
138	C. J. Bishop,	Benton	860	14.2	85.00	23 9	Sandy loam	April 10	" 15	Cultivated four times, hoed four times.
139	M. J. Duffy,	Union	676	21.5	88 10	5.0	Black loam	May 10	" 15	Hoed and irrigated twice.
140	R. S. Reed,	Lane	660	15.3	88.10	22.8	" "	" 13	Nov 7	Hoed twice, weeded twice.
142	J. K. Sampson,	Yamhill	352	14.8	87.00	6.8	" "	" 26	Nov —	Hoed and plowed once.
144	W. E. Smith,	Malheur	570	20.2	84.90	12.0	Sandy loam	" 10	Oct 20	Hoed three times.
145	C. D. Nain,	Polk	1623	14.0	74.20	44.4	Black loam	April 20	Nov 5	Hoed four times, cultivated four times
146	J. H. Rinck,	Washington	165	17 7	76.60	10.5	Sandy loam	May 11	" 7	Hand cultivated once.
147	William Bogue,	Benton	873	15.0	80.60	15.1	" "	" 20	" 1	Cultivated three times.
148	J. W Beatty,	Marion	840	13.0	80.70	45.0	" "	" 5	" 14	Cultivated and hoed six times.
150	C. C. Stanley,	Union	316	23 8	91.90	....	" "	" 13	" 4	Plowed 15 inches, spaded, hoed twice.
151	John End,	Wasco	330	21.1	90.50	7.5	Loam	April 16	Sept 22	Plowed twice, cultivated once.
153	J. H. Bard,	Douglas	623	14.5	77.90	40.4	Clay loam	May 20	Nov 12	Cultivated four times.
154	"	"	843	16.1	75.90	36.1	" "	" 20	" "	" " "
157	J. E. Reynolds,	Union	633	20.9	85.42	22.0	Heavy "	" 1	Oct 1	Hoed three times.
158	Robert Deal,	"	236	16.2	76.04	....	Black loam	" 1	" —	.....
159	F. Clairhorn,	Douglas	323	13.2	82.30	.....	Clay loam	April 1	Nov 30	Cultivated once.
160	W. H. Norcross,	"	803	10.9	83.20	17.4	Sandy loam	May 1	" 24	Cultivated six times, hoed twice.

Summary of Results for 1892.

Seed was sent to 140 farmers 20 of whom reported absolute failure of crop on account of unfavorable weather, and two on account of insect pests and squirrels.

The average of all analyses for the State was 15.7 per cent sugar in the juice with a purity of 78.08 against 13.75 per cent and a purity of 77.57 for last season. Out of the 65 analyses made only 11 indicated less than 12 per cent sugar in the juice, and 41 samples indicated over 14 per cent, the extremes being 9.4 per cent and 23.8 per cent. The average for the different natural divisions of the state were as follows:

Willamette Valley, 44 samples..... .....14.7 per cent.
Eastern Oregon, 11 samples.. .....19.2 ,, ,,
Southern Oregon, 10 samples..... .....15.1 ,, ,,

Expressed by counties the averages are as follows:

COUNTY.	No. Analyses	Average for 1091	No. Analyses	Average for 1892	No Analysis	Average for U. S. Dept. Agriculture	Mean of Analyses made at Station.	Mean of all Analyses.
Benton..	39	12.30	20	12.80	5	14.34	12.30	12.57
Clackamas.	7	14.55	1	15.10	3	15.36	14.62	14.87
Columbia.....	1	13.74	0	.....	3	15.30	13.74	14.91
Coos.....	0	.....	0	.....	5	14.56	.....	14.56
Douglas	9	12.99	9	15.20	1	17.74	14.28	14.48
Jackson.....	3	18.93	1	15.00	1	18.94	17.94	18.34
Lane.....	16	14.32	2	15.20	6	14.24	14.42	14.40
Linn.....	5	13.54	1	17.10	1	14.15	14.13	14.13
Marion.....	1	15.99	2	13.80	2	14.15	14.59	14.38
Polk....	1	14.72	5	14.50	1	12.10	14.54	14.19
Union.....	3	15.84	7	19.80	2	14.32	18.61	17.89
Washington.....	1	13.96	10	15.50	3	12.49	14.69	14.41
Yamhill.....	1	10.73	5	13.70	0	.....	12.96	12.95
Josephine.....	0	.....	2	15.70	0	.....	15.70	15.70
Wasco.....	0	.....	1	21.10	0	.....	21.10	21.10
Malheur.....	0	.....	1	20.20	0	.....	20.20	20.20
Sherman.....	0	.....	0	.....	1	13.55	.....	13.55
Umatilla.....	0	.....	0	.....	1	15.12	.....	15.12

Gleaned from Reports.

96.—"The beets have gained 30 lbs. to the row (85 feet) since Oct. 1st."

97.—"Owing to the heavy rains in April, planting was very late, and drought later reduced the aggregate yield.

The land was new, had been in potatoes one year, no manure was used, a little plaster was sown at planting time. The result is not flattering but shows what may be done under very unfavorable conditions;upon land which had been longer in cultivation, and with a favorable season I should feel sure of 15 or 20 tons per acre. I base my "price per ton" upon, not less than 10 acres and a yield of 15 or 20 tons per acre, with cost of raising reduced to a minimum by using horse power."

104.—"I think sugar beets could be raised for $5.00 per ton in a favorable season."

109.—"The ground received water by sub-irrigation from sulphur springs."

117.—"Ground was two dry when seed was planted."

123.—"The season was very unfavorable and the cultivation was not perfect."

118.—"At $4.50 per ton the whole crop would have to be taken."

130.—"During the latter part of September and first of October about 10 per cent died and rotted from top downward."

137.—"I had bad luck with the seed sent me. Only 40 per cent of one lot came up and of another lot only about 50 per cent. So that without transplanting I could give only an approximate estimate of the yield per acre. I could not afford to grow them at any price around $4.00 per ton. I can use my land to better advantage with other crops. This was my first experience with any thing of the kind and could improve 50 per cent another year."

144.—"My plot of beets were a partial failure the seed sown in drills on the 10th of May. It was then raining and continued wet and cold for three weeks and only about one-third of the seed came up. These grew well, however, during the season, free from insects or disease."

151.—"This has been a very bad season for testing anything in the nature of beets. I do not think beet culture would be a success here without irrigation."

161.—"Beets should have been gathered before receiving so much rain —should be planted in April."

Concerning the failures most of the letters read about as the following:—

THE DALLES, Oregon, Oct. 29, 1892.

G. W. SHAW, Chemist Or., Exp. Station,

DEAR SIR:—I am very sorry to announce to you that I have none whatever. I planted the seed sent to me carefully and though late when planted, quite a good many seeds germinated. When the scorching weather came they *dried up* as did most all of my garden. The only root crop which amounted to anything with me was carrots which do finely here. I am sorry to report thus but do not see that I could in the least help matters. The soil was in fine tilth (summer fallowed the year previous) and free of weeds. I used a Planet, Jr. seed drill to plant the seed and cultivated them with a Planet, Jr. wheel hoe, besides doing a little hand weeding. With best wishes for success to your efforts, I am, Yours truly,

ALBERT S. ROBERTS, Box 107 The Dalles.

It will be evident from the data given above that in spite of the unfavorable conditions the results have surpassed those of a year ago.

Part. III.

As before stated, one of the things sought by this year's experiments was relative to the yield that might be expected from a sugar beet crop. The data given below will be drawn from the experiments of the entire two seasons. Altogether the reports for the present season are quite complete on this point. The results given are calculated from a measured plot according to the following instructions which were sent with each package of seed, this being the method used by the U. S. Department of Agriculture. This method was used in order that the results obtained might be comparable with those obtained elsewhere.

"When the beets seem to be mature select an average row and gather every plant along a distance which should vary as follows, according to width between rows:

From	rows	16	inches	apart	gather	75	feet.
"	"	18	"	"	"	66⅔	"
"	"	20	"	"	"	59.8	"
"	"	22	"	"	"	54¾	"
"	"	24	"	"	"	50	"

The number of beets growing in the row, of the length above mentioned, must be counted. The tops are then to be removed, the beets carefully washed free from dirt, wiped and weighed. When the row is not long enough to meet the conditions, take enough from the adjacent row to make up the required length. The number of beets harvested multiplied by 435.6 will give the total number per acre. The total weight of beets harvested multiplied by 435.6 will give the yield per acre."

Upon the above basis the following reports were made:

J. S. Powell	Benton	15.8
College Farm	"	5.8
G. R. Woodruff	"	18.0
"	"	38.0
C. J. Bishop	"	23.9
William Bogue	"	15.1
Average		19.1
A. J. Thompson	Clackamas	9.3
D. S. K. Buick	Douglas	25.0
W. L. Tower	"	8.2
B. D. Dyer	"	6.7
M. Lemmer	"	17.4
J. H. Bard	"	40.4
"	"	36.1
W. H. Norcross	"	17.4
Average		21.6
Edward Albright	Jackson	12.0
T. E. Hills	"	27.4
Average		14.7
H. C. Perkins	Lane	18.0
J. H. Crow	"	9.5
R. S. Reed	"	22.8
R. E. Cartwright	"	30.4
Average		20.2
M. Snyder	Linn	11.7
W. E. Smith	Malheur	20.2
J. Voorhees	Marion	21.5
J. W. Beatty	"	45.0
Average		33.2
A. W. Lucas	Polk	30.0
J. D. Stewart	"	21.7
C. D. Nain	"	44.4
Average		32.0
M. J. Duffy	Union	5.0
J. E. Rynolds	"	22.0
Average		13.5
J. H. Rinck	Washington	17.0
"	"	10.5
John Henry	"	5.0
S. P. Reeder	"	14.0
J. D. Rowell	"	21.0
O. P. Pointer	"	8.1
Average		12.6
M. O. Lownsdale	Yamhill	47.0
J. H. Sample	"	6.8
Average		26.9
E. F. Meissner	Josephine	15.2

An examination of this table reveals the fact that in spite of the unfavorableness of the season the average for the state was 23.18 tons per acre against 20.5 tons per acre for the year previous. In connection with this subject nothing more to the point could be said than the following:— "But results worked out on paper always vary from actual experience, and so it has happened with sugar beets. In California the yield has reached as high as 61 tons per acre (the highest reported for Oregon so far is 44.2 tons. G. W. S.) while in Nebraska the average during the past two years has been under 10 tons per acre."

The average yield at Watsonville, California, in 1886 was 21 tons per acre and the following averages have been obtained in other states:

Minnesota	15.0 tons per acre.
Wyoming	7.5 " " "
S. Dakota	8.1 " " "
Nevada	20.0 " " "
Colorado	26.0 " " "
Iowa	20.0 " " "
Indiana	30.0 " " "
New York	19.5 " " "

It is evident that, as with every other crop, the yield must necessarily depend upon many things, as variety, distance between rows, soil, cultivation, and season, hence this will always be a more or less varying factor. I think, however, that for the Willamette Valley, and Southern Oregon in general, an average of 15 tons per acre is a very conservative estimate.

In Eastern Oregon the uncertainty of the season renders the ability to irrigate almost an essential condition, and if this is met, there can be little doubt but that the yield would even exceed that for Willamette Valley.

CULTIVATION.—Too much cannot be said upon this subject, for in the cultivation lies the secret of success in sugar beet culture. It has been said "The sugar is hoed into the beet," and this is literally true.

Well drained land is necessary, for the beet demands a deep, loose soil so the long tapering tap root may penetrate and drink well of the soil moisture, the development of sugar not reaching a high per cent in irregular shaped beets. It is essential that the beets be *kept close together in our soils* or they grow to enormous size. Some having been sent to us weighing as much as 10 lbs. Such beets are worthless for sugar and a manufacturer would not take them as a gift. The sugar varies inversely as the size of the beet. Beets for the manufacture of sugar should not attain a weight of more than 2 pounds. Pagnoul has conducted experiments extending over 8 years intending to show this.

DISTANCES APART IN INCHES.	PER CENT SUGAR.	YIELD PER ACRE.
Wide distance, 20 x 20	10.2	28.40
Narrow " 17 x 8	12.2	36.05

The same may be shown by the following Oregon produced beets, selected at random from the tables:

SIZE.	VARIETY.	Wt. in grams.	Per cent Sugar in juice.	Purity.
Small beet.	White Imperial	192	20.60	84 32
"	Klein Wanzlebener	341	19.00	67.80
"	White Imperial	250	16.70	88.30
"	Early Rose	165	17.70	76.60
"	Klein Wanzlebener	236	16.20	76.04
"	Vilmorin	350	18.00	82.13
Average		256	18.00	79.19
Medium beet.	White Imperial	538	14.70	71.80
"	Klein Wanzlebener	865	14.15	81.79
"	White Imperial	803	10.90	83.20
"	Desprez Early Rose	980	14.00	82,90
"	Klein Wanzlebener	920	15,99	78.38
"	Vilmorin	1021	13.40	54.10
Average		856	13.86	75.36
Large beet.	White Imperial	1623	14,00	74 20
"	Klein Wanzlebener	1880	14.41	80.55
"	White Imperial	1416	19.30	77.20
"	Desprez Early Rose	1970	11.90	85.00
"	Klein Wanzlebener	1700	12.88	80.00
"	Vilmorin	1700	9.81	68,12
Average		1715	13.71	77.51

One of the most important of all things for the farmer to understand is that at all times must the root be kept below the ground. Bulletin No.

67, Guelph Agricultural College Ontario, calls attention to this and gives the following to illustrate.

		Amt. of sugar	Purity.
Well grown, average of	top	15,5	82.7
	bottom	16.6	83.0
Poorly grown " "	top	11.4	69.9
	bottom	13.6	77.2

Cost of Raising.—This is one of the most pertinent questions relating to the subject, and at the same time is the most difficult one to answer satisfactorily, since there are so many factors in the problem. The question "At what price per ton could you afford to raise beets in quantity," was asked on the report blank sent out this year, and of the 28 farmers who answered the question, 15 stated $4.00 or less, some stating as low as $2.00. One or two named the extreme price of $8.00, but this was based upon all hand labor. The agricultural department of the college failing to keep an accurate record of the experiment renders it impossible to give definite data from that source. The estimates for the previous season ranged from $11. 25 to $24. 18 per acre, some including harvesting and some not, and none including the cost of hauling to market. I insert the statement of a gentleman from California which covers the question as fully as possible, and the items given do not differ far from the same items in this state.

"A. F. Richardson,two miles from factory, eleven acres: Plowing and harrowing, $110; sowing $6; harrowing and sowing, $3; 4 days' cultivation first time at $2—$8; 23 days' thinning at $1.25—$28.75; 24½ days' thinning and hoeing at $1.25—$30.65; 5 days' hoeing at $1.25—$6.25; 9 days' hoeing at $1.75—$15.75; 7 days' hoeing at $1.75—$12.25; 9½ days' hoeing, second time, at $1.75—$7; fixing plow, $2.50; two knives, $1.50, 4 baskets, $3.50; topping and loading, 170. 05 tons at 80 cents—$136. 04; hauling at 50 cents, $85; plowing up at 20 cents, $34; total, $508. 59; yield, 170.05 tons value, $821.81; net profit, $413. 22 net profit *per acre*,$37. 56."

These results were obtained in 1889 when the farmers were practically unacquainted with the most economical methods of cultivation and it is safe to say that with a little more experience in the method of working, most of the items would be rendered somewhat lower. These figures are not theoretical, but are the actual accounts of a beet grower

The Manufacturer and the Farmer.—It would certainly be a grand thing for Oregon to have a sugar factory located within her limits, officered by men of experience and ability, and while we would not say anything to discourage yet there is no royal road to riches even through the sweetness of the sugar beet, and success will only come through the efforts of the patient, careful, and persevering.

The question as to whether or not farmers should grow beets depends upon whether or not factories are established to use the beets, and *vice versa*, hence it is a question of double issue and can only be solved by co-operation. It is a lamentable fact—yet no less a fact—that the farmer looks upon the manufacturer as one who is at all times and under all circumstances trying to get the better of him, and this serves as a great barrier to success in the production of beet sugar.

In this industry, as in no other are the producer and the manufacturer linked hand in hand, and what is money in the pocket of one is also money in the pocket of the other, and neither can prosper without the other. From the standpoint of the manufacturer there are many

things to be considered before the establishment of a sugar factory, and after it has been shown that the natural conditions are favorable the main question is the supply of beets. The enterprise requires a large capital, and if Oregon enters the arena and is successful it will be with the most modern appliances, and true economy would demand an outlay of not less than $250,000. A plant of this capacity would require a large number of beets, the growing of which would require at least 5000 acres of land. Such a factory could well be located between two townships, and not be handicapped by the hauling distance.

The farmer's side of the question is one that can be practically settled by experiments, and in fact, outside of the actual cost of raising larger crops has been demonstrated in the experiments, but the cost of raising 10 acres of beets, when equipped for the work, is of course relatively less than for a small plat of land, hence the cost will be less than the average reported, and I am confident they can be raised at $4 per ton and leave *a fair* profit.

The manufacturer practically has all the risk to run unless he can actually be assured of a sufficient supply of beets. If he cannot be thus assured of course we have no factory, for no man or combination of men would invest $250,000 in an enterprise which would be entirely at the caprice of the farmers. There must be some written agreement binding both parties.

It is not within the scope of this publication to discuss the methods of organizing and conducting such an enterprise as the one in question, although the writer would be pleased to correspond with any parties interested in the subject, and offer any suggestion that he may be able.

CONCLUSIONS.—1—Good sugar beets can be produced in Oregon.

2—They can be raised at a price a factory can afford to pay.

3—The yield compares favorably with that of states now raising beets for the manufacture of sugar.

4—The crop of beets cannot be depended upon in some parts of the State unless irrigation is practiced.

5—That the success of the farmer will depend more upon skill and industry than on the soils, for poorly cultivated beets contain a lower percentage of sugar and purity than well cultivated.

6—Large beets do not contain so large a percentage of sugar as small beets and the purity is less.

7— Upon no condition should farmers grow beets to the exclusion of other crops, but should make this a rotation crop, substituting for bare fallow, if a factory should be started near them.

8—The amount of cultivation necessary for beets in Oregon renders it important that no one farmer should attempt to care for more than 12 acres per season.

9—The plants should be left as far apart as possible and not allow the roots to attain a weight of more than 2 pounds in order that as much cultivation as possible may be done by machinery.

10—If any state can manufacture its own sugar, or any part of it, successfully, Oregon should be able to do so since she has all the natural requirements.

In view of the foregoing all possible encouragement should be given toward directing attention to Oregon as a State suitable for this industry and to securing the attention of any one interested in such an enterprise.

The farmers have it mainly in their own hands for their willingness to each contract to grow a small acreage of beets will be the main factor for the manufacturer to handle.

Table of Analyses of Sugar Beets, 1891--1893.

	GROWER.	LOCALITY. POST OFFICE & COUNTY	SUGAR. Weight in Grams.	Sugar in Juice	Sugar in Beet.	Solids not Sugar.	Brix.	Purity.	Pounds Sugar Per Ton.	VARIETY OF BEETS.
1	Edw. Albright	Ashland, Jackson,	244	14.00	13.1	5.3	19.3	72.53	280.0	Klein Wanzlebener.
2	A. W. Lucas	Monmouth, Polk	624	14.72	13.3	4.2	18.8	78.08	294.4	" "
3	D. S. K. Buick	Roseburg, Douglas	1700	9.81	9.3	4.6	14.4	68.12	196.2	" "
4	do do	do do	1140	10.07	9.1	3.9	14.0	71.21	201.4	Vilmorin Improved.
5	J. Voorhees	Woodburn, Marion	920	15.99	14.6	4.4	20.4	78.38	319.8	Klein Wanzlebener,
6	H. C. Perkins	Llewellyn, Lane	739	17.06	16.0	4.3	21.3	80.09	341.2	" "
7	do do	do do	600	14.96	12.7	5.3	20.3	69.26	299.2	" "
8	L. F. Wilson	Corvallis, Benton	389	13.46	10.9	6.3	19.8	66.36	269.2	Unknown.
9	College Farm	do do	375	13.28	12.0	4.4	16.4	80.97	265.6	Vilmorin.
10	H. C. Perkins	Llewellyn, Lane	1200	17.70	16.1	4.3	22.0	80.45	354.0	Klein Wanzlebener.
11	College Farm	Corvallis, Benton	335	12.03	11.4	3.1	15.2	79.91	240.6	Lane's Imperial.
12	do do	do do	250	12.39	11.6	2.5	14.9	83.15	247.8	" "
13	do do	do do	339	14.63	12.7	2.7	17.3	84.57	292.6	Klein Wanzlebener.
14	do do	do do	216	14.02	12.6	2.8	16.8	83.45	280.4	" "
15	do do	do do	208	16.35	14.0	3.5	19.8	82.56	327.0	Dippe Klein Wanzlebener.
16	do do	do do	312	13.50	11.9	4.5	17.0	79.41	270.0	" " "
17	J. S. Powell	Philomath, do	384	13.08	12.4	3.8	16.9	76.80	261.6	Vilmorin Improved.
18	do do	do do	388	11.36	10.8	5.2	16.6	78.48	227.2	" "
19	do do	do do	465	11.97	10.8	5.0	17.0	70.45	239.4	" "
20	do do	do do	594	13.07	11.8	5.1	18.2	65.06	261.4	" "
21	C. J. Bishop	Tidewater, do	397	14.46	13.7	5.1	19.6	73.77	289.2	" "
22	College Farm	Corvallis, do	185	12.86	11.5	3.0	15.9	80.88	257.2	Dippe Klein Wanzlebener.
23	do do	do do	285	12.51	11.3	3.3	15.9	78.61	250.2	Klein Wanzlebener.
24	do do	do do	200	9 73	9.0	2.5	12.3	79.10	194.6	Lane's Imperial.
25	do do	do do	200	13.00	11.9	2.9	15.9	81.76	260.0	Vilmorin Improved.
26	do do	eo eo	780	12.88	11.5	3.7	16.6	77.59	257.6	Klein Wanzlebener.
27	do do	do do	642	12.05	11.0	4.7	16.8	71.78	241.0	" "
28	J. D. Wilson	Yoncalla, Douglas	348	14.75	14.0	3.8	18.5	79.72	295.5	" "
29	do	do do	496	14.32	13.3	6.0	20.4	70.16	286.4	Vilmorin Improved.
30	A. R. Shipley	Oswego, Clackamas	.....	12.00	10.9	3.1	15.1	79.47	240.0	Dippe Klein Wanzlebener.
31	do	do do	945	12.71	11.8	4.6	17.4	73.04	254.2	" " "
32	John Rickard	Corvallis, Benton	1100	9 81	8.4	5.1	15.0	65.40	197.2	Klein Wanzlebener.

33	John Rickard	Corvallis, Benton	700	6.76	6.0	4.7	11.5	58.78	135.2	Vilmorin.
34	do	do do	650	8.16	7.0	3.4	12.6	64.92	163.2	"
35	I. N. Sanders	Union, Union	350	18.07	16.6	4.9	22.0	82.13	361.4	"
36	do	do do	475	15.52	14.4	3.7	19.3	80.04	210.4	"
37	C. L. Gowell	Toledo, Benton	205	17.29	16.1	4.0	21.3	80.37	345.8	Klein Wanzlebener.
38	P. Cooper	Roseburg, Douglas	1150	13.42	11.5	2.8	16.3	76.19	278.4	Vilmorin Improved.
39	B. F. Collins	Fir, Washington	375	9.95	9.4	2.6	12.6	[illegible].96	199.0	" "
40	G. W. Mitchell	Newburg, Yamhill	975	10.73	9.8	3.2	14.0	76.64	214.6	Klein Wanzlebener. (?)
41	B. F. Collins	Fir, Washington	1145	12.17	11.38	3.2	15.4	[illegible].90	243.4	" "
42	G. W. Mitchel	Newburg, Washington	1115	11.64	10.52	4.5	16.1	7[illegible].29	232.8	" "
43	J. C. Johnson	Scappose, Columbia	465	13.74	13.14	3.6	17.3	[illegible].42	274.8	Vilmorin.
44	J. H. Rinck	Buxton, Washington	225	15.61	14.58	4.2	19.8	[illegible].83	312.2	Klein Wanzlebener.
45	W. H. Smith	Roseburg, Douglas	665	10.34	9.12	2.0	12.3	[illegible].04	406.8	Unknown.
46	H. Marks	do do	1230	10.80	10.26	4.2	15.0	7[illegible].09	261.0	"
47	John Withers	Lebanon, Linn	187	12.93	11.62	2.6	15.7	[illegible].23	258.6	Vilmorin Improved.
48	John Henry	Beaverton, Washington	480	14.38	12.62	1.8	16.2	8[illegible].70	287.6	Redtop.
49	do do	do do	340	13.02	12.14	5.1	18.2	7[illegible].53	260.4	Klein Wanzlebener.
50	College Farm	Corvallis, Benton	475	13.36	12.06	3.4	16.8	71.78	267.2	Vilmorin.
51	do do	do do	509	12.51	11.91	3.1	15.7	79.61	250.2	Klein Wanzlebener.
52	do do	do do	283	12.05	11.52	4.8	16.9	71.30	241.0	Dippe Klein Wanzlebener.
53	do do	do do	170	12.12	11.10	3.9	16.0	75.75	242.4	" " "
54	do do	do do	155	12.82	11.68	3.8	16.7	76.75	256.4	Lane's Imperial.
55	do do	do do	225	12.42	11.18	3.4	15.9	78.11	248.4	Vilmorin.
56	Samuel Howard	Eugene, Lane	1300	13.00	11.97	3.9	17.0	76.47	260.0	Unknown.
57	do do	do do	1016	11.30	9.81	4.1	15.4	73.37	226.0	"
58	R. Scott	Milwaukie, Clackamas	1213	12.82	12.91	2.98	16.8	82.26	276.4	Klein Wanzlebener
59	do do		200	12.18	11.66	4.2	16.4	74.26	243.6	" "
60	T. Pavey	Yaquina, Benton	850	16.23	14.43	2.6	18.9	85.82	224.6	Unknown.
61	E. Terpenning	Eugene, Lane	865	14.15	13.76	3.1	17.3	81.79	183.0	Klein wanzlebener.
62	do	" "	1880	14.41	13.58	3.3	18.0	80.55	288.2	" "
63	do	" "	550	15.18	13.74	1.9	17.0	89.29	303.6	" "
64	M. H. Harlow	" "	1700	12.88	12.38	3.2	16.1	80.00	757.6	" "
65	do	" "	930	15.36	14.20	2.8	18.2	84.39	307.2	" "
66	do	" "	340	17.61	15.74	2.0	19.6	89.84	352.2	" "
67	do	" "	575	14.82	13.09	2.7	17.6	84.20	296.4	" "
68	W. W. Crow	Lorane, Lane	682	11.30	10.22	4.7	16.0	76.62	226.0	Dippe Klein Wanzlebener.
69	J. H. Crow	" "	215	15.69	14.23	2.7	18.4	90.70	313.8	" "
70	C. J. Bishop	Tidewater, Benton	875	13.42	12.24	3.3	16.8	74.88	268.4	Klein Wanzlebener.
71	W. R. Wise	New Bridge, Union	1150	13.95	12.67	4.1	18.0	77.50	279.0	" "
72	J. H. Rosebrook	Toledo, Benton	450	13.68	12.16	4.7	18.4	74.34	273.6	Dippe Klein Wanzlebener.
73	do	" "	460	13.42	11.92	3.8	17.3	77.57	268.0	.....
74	C. J. Bishop	Tidewater, Benton	927	14.68	13.95	3.9	18.6	78.82	293.6	Vilmorin.
75	John Gage	Stafford, Clackamas	720	16.05	15.07	5.3	22.4	71.65	321.0	Klein Wanzlebener.
76	do	" "	875	13.42	12.14	4.7	18.2	73.73	268.4	" "
77	C. J. Bishop	Tidewater, Benton	412	15.57	14.85	2.4	18.0	86.00	311.4	Bulteau Desprez.
78	do	" "	405	14 17	13.12	2.3	16.6	84.75	283.4	" "
79	James Wilkinson	Beaver Creek Benton	1075	12.55	11.59	4.6	17.3	72.54	251.0	Unknown.
80	Albert Brown	Philomath, "	825	12.03	11.23	4.3	16.4	73.35	240.6	

Table of Analysis of Sugar Beets, 1891-1893.

	GROWER.	LOCALITY. POST OFFICE & COUNTY.	Weight in Grams.	SUGAR. Sugar in Juice.	Sugar in Beet.	Solids not Sugar.	Brix.	Purity.	Pounds Sugar per Ton.	VARIETY OF BEET.
81	J. H. Rinck	Buxton, Washington	305	15.71	14.38	6.2	22.0	71.40	314.2	Klein Wanzlebener.
82	do	do do	250	18.80	16.09	3.0	20.9	89.94	376.0	" "
83	Edw. Albright	Ashland, Jackson	325	20.56	19.30	3.1	24.7	87.21	411.2	" "
84	do	do do	255	22.24	20.99	3.2	25.5	79.88	287.6	" "
85	G. H. Baber	Forest Grove, Washington	830	14.38	13.08	3.6	18.0	76.94	292.4	
86	J. G. Stevenson	Eugene, Lane	495	14.62	13.25	4.3	19.0	58.68	151.4	Vilmorin Improved.
87	do	do do	475	7.57	5.88	5.3	12.9	70.87	226.8	" "
88	J. B. Riddle	Riddle, Douglas	865	11.34	10.48	4.6	16.0	68.04	241.0	Klein Wanzlebener.
89	do	do do	1010	12.05	11.93	4.6	17.7	83.01	380.0	" "
90	W. E. Smith	Vale, Malheur	350	19.00	17.69	2.8	22.9	81.98	272.2	" "
91	O. P. Coshow	Brownsville, Linn	450	13.61	11.58	3.0	16.6	72.16	226.6	Unknown.
92	do	do do	950	11.33	10.53	4.3	15.7	72.16	397.4	"
93	do	do do	750	9.87	8.48	1.7	11.6	85.08	200.0	"
94	do	do do	600	10.00	8.98	2.7	12.8	76.12	304.8	"
95	A. N. Ault	Forest Grove, Washington	375	15.24	15.00	6.0	21.3	71.54	266.0	Vilmorin Improved.
96	E. C. Meissner	Kebyville, Josephine	393	16.00	15.20	5.5	21.5	74.41	320.0	Early Rose.
97	A. J. Thompson	Oswego, Clackamas	325	15.20	14.40	2.3	17.5	86.85	314.0	" "
98	J. J. Odale	Union, Union	405	16.10	15.20	1.6	17.7	90.95	332.0	Klein Wanzlebener.
99	A. J. Goodbrod	do do	817	23.00	21.90	3.9	26.9	85.50	460.0	" "
100	College Farm	Corvallis, Benton	2468	12.60	11.90	1.8	14.4	90.95	252.0	" "
101	do do	eo do	2900	11.20	10.60	2.0	12.6	88.80	224.0	Vilmorin.
102	do do	do do	3326	15.50	14.70	2.2	17.7	87.50	301.0	White Imperial.
103	do do	do do	4526	13.90	13.20	1.8	15.0	92.60	278.0	Early Rose.
104	S. P. Reeder	Greenville, Washington	532	18.20	17.30	3.8	22.0	78.68	374.0	White Imperial.
105	College Farm	Corvallis, Benton	270	12.70	12.00	2.7	14.7	86.53	254.0	Klein Wanzlebener.
106	do do	do do	300	12.60	12.00	1.4	14.0	90.00	252.0	Vilmorin.
107	do do	do do	303	13.90	13.10	1.8	15.7	89.10	278.0	White Imperial.
108	do do	do do	305	10.00	9.50	1.7	11.7	85.88	200.0	Early Rose.
109	T. E. Hills	Ashland, Jackson	783	15.00	14.20	2.7	17.7	84.74	300.0	Desprez Early Rose.
110	J. M. Hirsh	Union, Union	605	17.00	16.20	1.5	18.5	93.40	340.0	Unknown.
111	College Farm	Corvallis, Benton	340	11.00	10.40	3.2	14.2	77.40	220.0	Klein Wanzlebener.
112	do do	do do	490	9.80	9.30	3.1	12.9	76.29	196.0	Vilmorin.
113	do do	do do	263	11.40	10.80	1.2	12.6	90.46	228.0	White Imperial.

114	College Farm	Corvallis, Benton	296	13.70	13.10	1.7	15.4	88.97	274.0	Early Rose.
115	H. Buxton	Forest Grove, Washington	1970	11.90	11.30	2.1	14.0	85.00	238.0	" "
116	do	do do	525	13.10	12.40	3.0	16.1	81.42	262.0	" "
117	do	do do	1045	14.30	13.60	1.8	16.1	88.80	286.0	" "
118	T. R. Cornelius	Cornelius, do	567	12.00	11.40	3.0	15.0	80.00	240.0	Desprez Early Rose.
119	Geo. R. Woodruff	Philomath, Benton	620	9.40	8.90	2.1	11.5	87.70	188.0	Early Rose.
120	do	do do	640	12.90	12.30	2.8	15.7	82.17	258.0	Vilmorin.
121	do	do do	776	11.90	11.20	2.6	14.5	82.17	238.0	Klein Wanzlebener.
122	M. P. Jones	Perrydale, Polk	1022	13.40	12.70	1.4	24.8	54.10	268.0	Vilmorin.
123	W. C. Tower	Oakland, Douglas	1938	20.60	19.60	3.7	24.3	84.32	412.0	White Imperial.
124	J. D. Rowell	Scholl's Ferry, Washington	341	19.00	18.00	9.0	28.0	67.80	380.0	Klein Wanzlebener.
125	College Farm	Corvallis, Benton	375	.....	.....	....	....	.....	.....	Early Rose.
126	do do	do do	367	14.40	13.50	2.4	16.8	85.70	288.0	Klein Wanzlebener,
127	do do	do do	250	16.70	15.80	2.2	18.9	88.30	234.0	White Imperial.
128	B. D. Dyer	Myrtle Creek, Douglas	291	11.30	10.80	3.0	14.3	79.02	226.0	.....
129	B. E. Cartwright	Eugene, Lane	568	15.10	14.30	2.9	18.0	83.09	302.0	Desprez Early Rose.
130	Michael Lemmer	Roseburg, Douglas	458	15.00	14.20	1.6	16.6	73.40	300.0	Klein Wanzlebener.
131	O. P. Pointer	Hillsboro, Washington	538	14.70	14.00	6.0	20.7	71.80	294.0	White Imperial.
132	M. Snyder	Plainview, Linn	617	17.10	16.20	6.1	23.3	73.40	342.0	Early Rose
133	J. D. Leonard	Ballston, Polk	750	18.70	17.70	5.7	24.4	76.60	374.0	Klein Wanzlebener.
134	Jas. Edson	Carlton, Washington	1416	19.30	18.20	5.7	25.0	77.20	386.0	White Imperial.
135	S. W. Gaines	Hubbard, Marion	558	14.60	14.00	6.7	21.3	68.50	292.0	.....
136	M. O. Lownsdale	Lafayette, Yamhill	980	14.00	13.30	3.0	17.0	82.90	280.0	Early Rose.
137	do	do do	1050	12.50	12.00	3.4	15.9	78.60	250.0	Klein Wanzlebener.
138	C. J. Bishop	Tidewater, Benton	860	14.20	13.40	2.5	16.7	85.00	288.0	Early Rose.
139	M. J. Duffy	Cove, Union	676	21.50	20.40	2.9	24.4	88.10	430.0	.....
140	R. S. Reede	Creswell, Lane	660	15.30	14.40	2.7	18.0	85.00	306.0	Vilmorin.
141	B. C. Hawley	Logan, Clackamas	352	15.10	14.30	1.9	17.0	88.80	302.0	Klein Wanzlebener.
142	J. K. Simpson	North Yamhill, Yamhill	351	14.80	14.10	2.2	17.0	87.00	296.0	Desprez Early Rose.
143	B. F. Church	Monmouth, Polk	770	15.40	14.40	1.6	17.0	90.58	308.0	Vilmorin.
144	W. E. Smith	Vale, Malheur	570	20.20	19.10	3.6	23.8	84.90	404.0	Desprez Early Rose.
145	C. D. Nain	Ballston, Polk	1623	14.00	13.30	4.6	18.6	74.20	280.0	White Imperial.
146	J. H. Rinck	Buxton, Washington	165	17.70	16.80	4.1	21.8	76.60	354.0	Klein Wanzlebener.
147	Wm. Bogue	Toledo, Benton	873	15.00	14.20	3.6	18.6	80.60	300.0	Early Rose.
148	Z. W. Beatty	Chemawa, Marion	840	13.00	12.30	3.1	16.1	80.70	260.0	Vilmorin.
149	R. S. Barclay	Tidewater, Benton	210	19.40	18.40	3.5	22.9	83.40	388.0	White Imperial.
150	C. C. Stanley	Imbler, Union	310	23.80	22.60	2.1	25.9	91.90	476.0	Desprez Early Rose.
151	John End	Warmic, Wasco	330	21.10	20.00	2.2	23.3	90.50	422.0	Early Rose.
152	E. F. Meissner	Kebyville, Josephine	400	15.40	14.60	2.1	17.5	88.00	308.0	Desprez Early Rose.
153	J. H. Bard	Oakland, Douglas	623	14.50	13.70	4.1	18.6	77.90	290.0	White Imperial.
154	do	do do	843	16.10	15.30	5.1	21.2	75.90	322.0	Unknown.
155	P. J. Bond	Peel, Douglas	225	14.10	13.40	1.8	15.9	88.61	282.0	"
156	do	do do	246	21.50	20.40	2.4	23.9	85.77	430.0	Klein Wanzlebener.
157	J. E. Reynolds	La Grande, Union	633	20.90	19.80	2.4	23.3	85.42	418.0	Desprez Early Rose.
158	Robt. Deal	do do	236	16.20	15.30	6.1	22.3	76.04	324.0	Early Rose.
159	F. Clairhorn	Oakland, Douglas	323	13.50	12.80	3.1	16.4	82.30	270.0	Vilmorin.
160	W. H. Norcross	Central Point, Douglas	803	10.90	10.30	2.2	13.1	83.20	218.0	White Imperial.
161	A. H. Sampson	Lewisville, Polk	930	11.30	10.70	4.6	15.9	71.00	226.0	Vilmorin.

Analyses of Oregon grown Sugar Beets made by the Department of Agriculture at Washington, D. C. *

GROWER	COUNTY.	Weight in grams	SUGAR IN Juice.	SUGAR IN Beet.	Purity.	Solids.	Yield per acre tons.	VARIETY.
Herman Benke	Benton	370	13.88	13.18	79.3	17.49	.....	German.
J. J. Nye	"	355	13.30	12.65	78.4	16.97	7.5	"
C. J. Bishop	"	335	15.40	14.63	87.5	17.61	16.6	Bulteau Desprez.
G. H. Rosebrook	"	300	14.05	13.35	83.1	16.89	6.5	Klein Wanzlebener.
Henry Delinger Jr	"	1589	15.05	14.30	85.4	17.64	25.9	.....
Average		628	14.34	13.71	82,8	17.32	14.12	
Thos. Daniels	Clackamas	500	19.88	18.88	87 6	22.68	16.7	.....
O. P. Yodler	"	105	14.55	13.82	86.5	16.83	.....	Klein Wanzlebener.
Richard Scott	"	1155	12.25	11.62	77.0	15.91	.....	" "
Average		586	15.56	14.78	84.2	18.47	16.7	" "
Clarence Reed	Columbia	275	16.50	15.67	83.9	19.67	17.0	" "
" "	"	830	15.60	14.82	79.8	19.67	20.0	" "
J. C. Johnson	"	535	13.90	13.21	86.0	16.17	11.5	.....
Average		546	15.30	14.56	81.7	18.50	16.2	
J. M. Perkins	Coos	1030	13 00	12.35	80 8	16 31	.....	Klein Wanzlebener,
Mat Kerrigan	"	600	14.50	13.77	83.8	17.31	.....	Vilmorin.
" "	"	830	14 65	13.92	80.5	17.71	.....	Klein Wanzlebener.
John B. Fox	"	975	16 80	15.96	87.0	19.31	.....	.....
T. T. Smith	"	865	13.85	13.16	79.1	17.51	.....	Vilmorin Improved.
Average		860	14.56	13,83	82,6	17.63	.....	
W. L. Tower	Douglas	340	17.74	16.85	84.3	21.03	.....	German.
Edward Albright	Jackson	570	18.94	17.99	83.9	22,57	17.8	.....
J. G. Stevenson	Lane	115	12.15	11.54	77.5	15,67	6.5	Vimorin Improved.
W. N. Crow	"	595	14.05	13.36	77,7	18.09	.....	.....
H. L. Perkins	"	475	13.95	13 25	81.2	17 17	.....	.....
J. H. Crow	"	230	17.50	16.63	84.6	20.68	11.8	.....
C. J. Dodd	"	815	15.10	14.35	83.9	17.99	.....	French.
L. Martin	"	1100	12 67	12.05	82.5	15.35	.....	.....
Average		550	14.24	13.53	85,4	17.49	9.2	.....
John Wither	Linn	180	14.15	13.42	79.5	17.81	.....	.....
Jacob Raber	Marion	1365	12.35	11.73	76,2	16.17	.....	.....
J. Voorhees	"	560	14.45	13.73	85.7	16.87	20,3	.....
Average		962	13.40	12.73	81.1	16,52	20,3	.....
James Douglas	Polk	880	12.10	11.50	79,8	15,17	.....	German.
J. E. David	Sherman	435	13.55	12,86	72.2	18,77	.....	.....
J. H. Logan	Umatilla	395	15.12	14,36	80.9	18,69	.....	French.
W. R. Wise	Union	980	14,10	13,40	81.0	17,39	.....	.....
" "	"	1130	14.55	13.82	82.6	17,59	.....	.....
Average		1055	14,32	13 61	81,8	17.49	.....	.....
J. H. Rinck	Washington	250	12.67	12 04	85 8	14.77	12,8	Klein Wanzlebener.
A. N. Ault	"	430	15.00	14.25	82 0	18.29	15.2	Vilmorin.
"	"	1365	9.80	9.31	68.3	14.38	18.3	"
Average		681	12.49	11 86	80.7	15.48	15.4	.....
Average for State		644	14,57	13.84	82,2	17.72	15.6	

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Oregon Agricultural Experiment Station

Bulletin No. 24. March, 1893.

AGRICULTURE.

1.--POTATOES.
2.--ROOTS.

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Agriculturist.

C. D. THOMPSON.
Foreman of Farm.

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POTATOES.

Potatoes were grown on the experimental grounds last season, in small plats to determine the character of growth, and adaptability to climate and soil; and in larger plats that a test of the yield might be made.

Seventy-one varieties were grown in small plats of from twenty to fifty hills each, and fifty-nine varieties in plats occupying one fortieth of an acre.

The soil, in which the potatoes were grown, is a clay loam. It is a soil, which is common in the Willamette Valley, occupying the higher portions of the land bordering on the white land.

Wheat was grown on the land the year before, producing a yield of thirty bushels per acre. After securing the wheat, the soil was given a good coating of barn-yard manure. This was plowed under as deep as possible during the winter. The land was again plowed six inches deep in spring just before planting. In addition to the plowing, the soil was thoroughly worked with a Clark cutaway harrow and a spring tooth harrow.

Too much stress can not be placed upon working soil thoroughly before planting. This is true in preparing soil for all crops, and especially is it true of potatoes, which require more moisture than some of the narrow leaved plants. The potato does not send its roots as far, in search of moisture as the corn plant; hence the surrounding moisture must be conserved in every possible way.

In the Willamette Valley, if the soil is thoroughly worked to a good depth before planting, there is little to fear from the dryness of the season.

The ground was further prepared by marking one way with rows 3 feet apart, and with furrows the other way the same distance apart making the rows three feet each way. The furrows were made with the shovel plow to the depth of six inches.

The seed was cut leaving two to three eyes on each piece. One piece was droped in each hill, and was covered with a hoe, so that the hill was a little above the surrounding ground. Deep covering will many times prevent the seed from becoming dried up before it germinates.

Unleached hard wood ashes, at the rate of 600 pounds per

acre, were sowed broad cast over the field, after planting was finished. Much valuable fertilizer goes to waste upon nearly every farm, in the shape of wood ashes. All kinds of root crops are especially benefited, by the potash contained in ashes. There is little danger of getting too much potash on the farm. It is one of the three substances, nitrogen, phosphoric acid, and potash, which form the "tripod" of Agriculture. Without the presence of these three, the farmer must close out his business. He will be closed out, sooner or later, whether he wills it or not, if he does not carefully guard the source of these substances.

After sowing the ashes the clod crusher was run over the field, to fill up the furrows, where the hoe had failed to do the work; and at the same time, to compress the dirt more closely about the seed.

It is a good plan to roll the potato ground after planting, if the soil is a little dry. This will assist the capillarity of the soil, enabling it to bring moisture up to the seed, thus insuring a more vigorous growth at the out-set.

During the cultivation the ground was kept as level as possible, believing that by this means we prevent the escape of moisture more, than when the soil is thrown up in ridges. Some, if not all of the best authorities upon potato culture in this country, recommend level culture for potatoes, and in fact for all kinds of plants. If we cultivate deep, some of the feeders of the plants are severed, and we thus cut off the means of gathering moisture and food.

In table I the date of planting, date of digging, and yield are given. The time of ripening is also indicated by the letters E. M. and L. signifying whether they are early, medium early or late.

The varieties are grouped according to yield, for more convenient reference. No. 1 in the list seems to have far out yielded the others. This is a rough, course grained potato, very firm, and a good keeper. Skin is a flesh color; inside white but not as clear white as some.

Of the seven other varieties, which yielded over two hundred bushels per acre, there is none better than the Sultan, so far as appearance and manner of growth indicate. It is a white, smooth potato; round in shape. Flesh is white and fine in texture. No

cooking test has been made, hence we only judge by its appearance.

The Early Rose needs no introduction. It is enough to say that it is one of the best early sorts, although not as early as some others. It is classed here as a medium early variety, as it has proved to be, for the past two years.

Dakota Red is one of the best late varieties, so far as yield and quality when cooked, are concerned. It is too ugly in appearance to become a favorite in the market.

The Champion is a flesh colored potato, rough in outline and course in texture. The eyes are deep giving the potato a rough appearance.

Thorburn's Late Rose is a good late variety resembling the Early Rose in shape and color.

The Tilden is also a rough potato, but a very firm, good keeper; flesh white; skin pinkish in color.

Of the varieties which yielded one hundred and fifty bushels, and under two hundred, the Gen. Logan, Pacific, Garfield, and White Cloud, are the most desirable types. These have been grown three successive years. Some of the other varieties are doubtless equally good; but they have not been tested long enough to warrant a conclusion.

Of the early varieties none excel the Early Sunrise and Silver Skin. The former is a flesh colored potato, white inside, and an excellent cooking potato. The Silver Skin is a handsome white potato as its name indicates. It is smooth and fine in texture.

Jones' Prize Taker proved successful, in some portions of the state, as grown from seed sent out by the Experiment Station, one year ago. It is not a heavy yielder; but the quality of the potato is all that could be desired.

A large number of the varieties tested have been grown only one season; hence further conclusions are withheld, until a more extended trial can be given them.

In order that a more thorough trial may be made, with some of those varieties which have proved successful at the Station, we will send to persons desiring to test them, a pound package each of two varieties; one early and one late, upon receiving address and ten cents, to pay for postage and packing, for each pound ordered. Address orders to Agriculturist,

Oregon Experiment Station,
Corvallis, Oregon.

Table I.

NAME.	No.	Date of Planting.	Date of Harvestng	Early, Med'm Late.	Yield per Acre in Bush.
Riley	1	May 18	Oct. 6	L	396
Champion	2	"	4	M	272
Dakota Red	3	"	4	L	263
Early Rose	4	"	3	M	239
Sultan	5	"	4	M	233
Commander	6	"	6	L	234
Thorburn's Late Rose	7	"	5	L	226
Tilden	8	17	Sept. 28	L	210
Burpee's Superior	9	"	28	M	187
Dublin Chief	10	"	30	M	178
Gen. Stark	11	"	30	M	187
Pacific	13	"	29	M	175
Garfield	14	"	30	M	187
Burling	15	18	Oct. 1	L	181
Paragon	16	"	6	M	177
Rubicund	17	"	6	M	180
Antwerp	18	"	7	M	175
Dakota Boss	19	"	7	M	175
Gen. Logan	20	17	Sept. 28	L	169
White Cloud	21	"	29	M	169
White Star	22	"	30	M	151
Peerless	23	"	29	L	150
Kent	24	"	Oct. 1	L	159
Rochester Favorite	25	18	3	L	162
Jumbo	26	"	1	L	156
White Rose	27	"	4	L	173
Vam	28	"	5	L	169
Parsons Prolific	29	"	6	L	155
O. K.	30	"	8	L	168
Perfect Peach blow	31	17	Sept. 28	L	134
State of Maine	32	"	27	E	130
Silver Skin	33	"	28	E	145
Early Sunrise	34	"	27	E	141
O. K. Mammoth	35	18	Oct. 1	L	138
Alexander's Prolific	36	"	1	M	141
Wig Wag	37	"	1	L	139
George III	38	"	1	L	131
White Lion	39	"	3	M	146
Plymmouth Rock	40	"	3	M	134
Zoar	41	"	4	M	144
Atlantic	42	"	5	M	141
Garnet Chili	43	"	7	L	142
Defiance	44	19	7	M	141
Princess	45	"	8	M	143
Manhattan	46	"	8	L	140
Magnolia	47	"	5	M	126
Garnet	48	"	8	L	127
Burpee's Improved	49	18	5	M	115
Pride of Mason	50	"	5	M	123
James Vick	51	"	7	L	122
Capricorn	52	"	7	L	117

Table I.

NAME.	No	Date of Planting.	Date of Harvesting	Early' Medi m Late.	Yield per Acre in Bushels
Old Merino	53	May 19	Oct. 7	L	115
Starr Russet	54	"	8	L	115
Rural Buttercup	55	"	7	E	103
Jones' Prize Taker	56	"	7	E	113
Addison	57	"	7	M	123
Comforter	58	" 18	1	M	119
Rural New York No 2	59	" 17	Sept. 27	M	80

FERTILIZER TESTS

Several plats were put out, with a view of testing some of the commercial fertilizers found in the markets upon this coast.

Table No II gives the yield per acre from the fertilized plats, as compared with a plat where no fertilizer was used.

The fertilizer was applied by sowing in the furrow or trench, and mixing thoroughly with the soil, before planting. In this way, the soil did not come in direct contact with any considerable amount of the fertilizer.

The sodium nitrate seemed to be too strong for the young shoots, killing them before they came through the ground. This fertilizer is of doubtful value to the potato crop.

Each of the other fertilizers produced a marked increase in the yield.

Peruvian Guano is one of the best fertilizers, that has been tested on the experimental grounds, in growing potatoes. Its action is quick, producing a marked increase in vigor of growth, from the time the potatoes start to grow, until they are matured. This fertilizer, as seen in the table, nearly trebles the yield over the plat where no fertilizer was used.

At 30 cents per bushel, the increase amounts to forty-seven dollars and ten cents per acre.

These figures may be higher than will be realized in general culture; but if it is reduced one half, there is still sufficient margin to warrant a thorough trial of this material.

What is said of guano is largely true of kainite, (German Potash Salts) and Superphosphate. These substances cost less

than the guano. The superphosphate sells for 2 to 2½ cents per pound, in the Portland market, and the kainite for 4 cents.

Mape's Potato Fertilizer gave a good increase over the yield from the plat which received no fertilizer: but it did not quite come up to that, from the three just mentioned. This fertilizer is one which is especially prepared for potato culture, and is listed at a little less than 2½ cents per pound in eastern markets.

It will be seen that unleached ashes, gave a fair increase in the yield. It is quite sufficient, to warrant the outlay in their application;

There were some indications of a too strong application of these, leading us to think that better results might be obtained by sowing them broad-cast, rather than in drills.

The potatoes which were fertilized received the same kind of cultivation as the remainder of the field, and were on the same kind of soil.

The plats were 1-40th acre in size. Burbank Seedling was the variety grown in this test.

Table II.

Name of Fertilizer.	Date Planting	Date Harvesting	Yield per acre Bushels.	Increase over no Fertilizer.	Remarks.
Kainite.....	May 20	Oct. 7	226⅞	145⅝	400 lbs per acre
Superphosphate.....	"	"	227¼	146	" " "
Peruvian Guano.....	"	"	239	157⅞	" " "
Sodium Nitrate.....	"	"	89	7⅞	" " "
Mapes' Potato Fert.	"	"	198⅔	117½	" " "
Unleached Ashes...	"	"	129½	48⅓	800 " "
No Fertilizer.....			81⅓		

Mangels.

Table No. III, shows the comparative yield of eleven varieties of mangle wurzels, grown under like conditions.

Generally the Globe variety did the best. The Mammoth Prize Red, gave a good yield; but it is not so smooth and fine in texture, as the Globe varieties.

The Orange Globe, is a standard variety throughout the country. It is easily harvested, on account of its carrying very few fine roots.

The varieties which produce a large number of fine roots, which adhere to the parent root, are objectionable on account of

holding so much dirt. They can not be stored in as good condition, and they do not keep as well.

The question is often asked, as to the comparative feeding value of roots and corn silage. In order to answer this question briefly, there is published in this Bulletin, a table showing the composition of roots, and corn silage, also the nutritive ratio of these substances.

By nutritive ratio, is meant the relative amount of digestible albuminoids or nitrogenous food elements, compared to the amount of digestible carbohydrates, or respiratory and fat producing substances.

It will be seen that roots have a less amount of carbohydrates than corn silage, with the exception of potatoes, which, on account of the large amount of starch contained, are relatively high in these substances.

The roots come nearer to a balanced ration than the silage; but because of the large percent of water contained, they do not make a satisfactory ration when fed alone. The same is true of silage; the best results being realized, when some nitrogenious food, such as linseed meal, bran, clover hay etc., is fed with it.

The chief objection to raising roots, on a large scale, is the expense of hand labor, which can not be wholly dispensed with. There is a time in the growth of roots, when hand labor must be used; and just at this critical time labor is scarce and wages high.

In growing corn all of the labor, to the time of harvesting, can be performed with horses. A much larger amount of dry food material can be obtained per acre from corn, than from roots, under ordinary circumstances.

However, no farmer can afford to neglect raising a small plat of roots to feed young stock, thus keeping them healthy and vigorous,

The roots were grown on a clay loam soil, which was manured the winter before, with a moderate application of barn-yard manure. The soil was plowed ten inches deep, and thoroughly harrowed.

The rows were three feet apart, and plants thinned to 8–12 inches in the row. Only one hand hoeing was necessary, at which time the plants were thinned to the required distance.

Table III.

Mangel Wurzel.

NAME OF VARIETY.	Date of Planting.	Date of Harvesting.	Yield per acre, tons cwt.	REMARKS
Mammoth Prize Red	May 19	Oct. 24	8–1	Long Red variety.
Chirk Casteel.....	"	"	6–17	....
Carter's Warden.....	"	"	7–14	Globe variety.
Orange Globe.....	"	"	10–4	Globe variety.
Vaughan's Mam.....	"	"	7–16	Long Red variety.
Giant Yellow...	"	25	8–13	Intermediate.
Golden Tankard.....	"	"	7–14	Between Globe and Long var.
Eschendorf.....	"	"	8–17	Medium Red.
Kniver's Globe.....	"	"	8–6	Yellow Globe variety.
Eschendorf.....	"	"	7–19	Medium Yellow.
Dignity.....	"	"	6–10	Yellow Globe variety.

Carrots.

Thirteen varieties of carrots were grown in plats, on the same kind of soil as the mangels. They were sowed in rows the same distance apart, and the plats received the same amount of cultivation as the mangels.

Some of the varieties gave a very fair yield, while others did not yield enough to make them of value, for feeding stock.

The smaller varieties, such as Jersey Queen, Altringham, and and Coreless are good table varieties.

Of the varieties which have been grown successfully upon the experimental grounds for several years, the Long White Belgian takes the lead, and the improved Long Orange is next. The Yellow Belgian is similar to the White Belgian in its manner of growth, but the flesh has a yellow tinge. The crown does not grow as high above the ground, and is more stocky than the white variety.

Among the new varieties grown, the Mastodon makes the best yield. It is smooth, uniform in shape and yellowish in color. The flesh is very firm, which is indicative of good keeping qualities.

Nicols' Improved is not as desirable as some of the varieties

which did not yield quite as much. It is not as smooth, as the last one mentioned, yet it may improve upon further trial.

The White Vosges, grown for the first time, last season, is one of the best varieties It is the most uniform in shape, of any variety, and is very smooth. The flesh is white and firm. The root maintains its size, toward the bottom, better than any other. Some of the varieties have a tendency to send a slim root, deep into the ground, which never develops to a desirable size.

In growing carrots, we have met with better success, than in growing mangels. The beets are affected by the dry weather, which prevails during the summer months, more than the carrots. Very often the Mangels will scarcely recover, from the affects of the drouth sufficient to make growth, after the rains come in September or October. It is not so with the carrots, which send their roots deeper, and are thus able to gather moisture from the lower layers of the soil. These roots seem to enjoy the dry weather, and, while they do not make much growth, are in a vigorous condition to make rapid strides during the fall. In 1891, the season was quite dry for mangels, yet the larger varieties of carrots produced specimens weighing from six to eight pounds.

The question is often asked: "are carrots good for dairy cows?" While we have never had an opportunity to use them in a butter dairy, they are constantly fed on the College farm to cows which furnish milk to the boarding hall, and no complaint is made as to taint, or quality of milk. It will be seen, in the table showing the composition of roots, that carrots do not contain as high a proportion of digestable carbohydrates. Bran, shorts, ground oats or oil meal would assist in making a good milk ration, when carrots are fed. For young calves and colts, and for older horses, carrots are a most excellent food to keep the digestive organs in a healthy and vigorous condition.

H. T. FRENCH,

Agriculturist.

Carrots.

NAME OF VARIETY.	Date of Planting.	Date Harvesting.	Yield per acre tons, cwt.	REMARKS.
Jersey Queen	May 19	Oct. 20	5—14	
Long White Belgian	"	"	7—4	Long slender variety.
Yellow Belgian	"	"	7—5	Large crown
White Vosges	"	"	7—6	Very smooth.
Long Scarlet Altringham	"	"	3—13	Not desirable for stock.
Danvers' half-long	"	"	6—13	Short, smooth.
Red St. Valery	"	"	5—5	Not desirable for stock.
New Long Red Coreless	"	"	2—17	Too small for stock.
Nicol's Improved	"	"	8——	Rough, not uniform.
Orange Belgian	"	"	4—13	Not desirable.
Improved Long Orange	21	"	6—6	Standard sort.
Mastodon	"	"	10—11	Excellent for stock.
Victoria	"	"	4—12	Rather rough.

Table showing composition of Roots, Tubers, and Corn Silage. *

NAME	Percentage composition.						Per cent digestible matter			
	Water.	Ash.	Crude Protien.	Crude Fiber,	Nitrogen-free extract.	Ether extract	Crude Protien.	Carbohydrates.	Ether extract	Nutritive ratio.
Corn Silage	79.1	1.4	1.7	6.0	11.1	.8	1.2	11.8	.6	1:10.9
Mangels	90.9	1.1	1.4	.9	5.5	.2	1.1	4.8	.....	1: 4.4
Rutabagos	88.6	1.2	1.2	1.3	7.5	.2	.9	7.1	.....	1: 8.9
Turnips	90.5	.8	1.1	1.2	6.2	.2	.6	5.5	.....	1; 9.2
Red beets	88.5	1.0	1.5	.9	8.	.1	.9	7.6	.....	1: 8.4
Sugar beets	86.5	.9	1.8	.9	9.8	.1	1.1	9.2	.....	1: 8.5
Carrots	88.6	1.0	1.1	1.3	7.6	.4	1.0	7.1	.....	1: 7.1
Potatoes	78.9	1.0	2.1	.6	17.3	.1	1.4	16.1	.....	1:11.5

*Taken from Report of Bureau of Animal Industry U. S. Dept. of Agriculture.

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Oregon Agricultural

Experiment Station

Bulletin No. 25. April, 1893.

ENTOMOLOGY:

CODLING MOTH AND MOP LOUSE.

ECONOMIC ZOOLOGY:

GOPHERS AND MOLES.

F. L. WASHBURN

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

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REPORT ON WORK WITH THE CODLING MOTH.

The following is a brief account of what has been accomplished with this pest in 1892. From the results attained it is believed that the number of necessary sprayings, and consequently the expense, can be reduced, and still accomplish the desired end.

In addition to the field work, the duration of the different stages of the insect's life has been carefully studied, and the result is suggestive of points of value to the horticulturist.

All plates and cuts in this and other articles of this bulletin (except Figs. 5 and 10) have been made from photographs by our photographer Mr. E. Pernot, and we wish to hereby acknowledge our appreciation of his pains-taking efforts. To Mr. Coote, the Station Horticulturist, our thanks are due for various courtesies.

In these experiments the trees used were from 35 to 40 years old. Only a few trees were taken in each case. As only one solution was a decided improvement over anything used hithertoo, we will pass rapidly over those three which met with only ordinary success.

Exp. No. 1 Flour paste and Paris green.—This was tried at the suggestion of an orchardist in Southern Oregon, who believed the paste could best withstand rain and would form an additional attraction to the moth. Two lbs. of flour were made into a paste with 6 quarts of water, added to 12 gal. water and 1 oz of paris green stirred into this mixture. This was not satisfactory.

Exp. No. 2 Paris Green alone.—This is the ordinary solution in general use,—1 lb. paris green to 300 gals. of water (1 lb to 300 gal. is strong enough) and about 15 lbs of soft or whale oil soap added to this to cause an even spreading of the liquid. The effect of the use of this mixture has been reported in Bulletin No. 10, and nothing further need be said here. It is a good agent but experience indicates that a comparatively large number of sprayings is necessary, with an interval of only 16 or 17 days between applications. This is corroborated by reports from various orchardists.

Exp. No. 3 IXL and Soap.— IXL is an insecticide for sale by Wm. F. Beck & Co., 117 California St. San Francisco, and 26 N. Front St., Portland, Oregon, and is apparently rapidly coming into favor. It sells in Portland at 4 cents per lb. in barrels (500 lbs to the bbl.); 4½ cents per lb.

per 60 lb. box; and 5 cents per lb in bricks, any quantity. A qualitative analysis of this agent by Prof. Lotz, our Station Chemist, shows that it contains lime, sulphur, and salt, or more exactly Calcic hydrate, Sodic Chloride, Calcic Sulphide and Sodic Sulphide. It was reported to contain no arsenic. The proportions used in this experiment were 1 lb IXL, 1 lb whale oil soap, 6 gals. water. As mentioned above the soap is used to cause the liquid to spread smoothly and evenly over the fruit, a very necessary thing.

The recipe given by the manufacturers of IXL for the codling moth, and we have experimented with this also, is similar, but the soap is omitted. The effect of either of these mixtures is not so good as the compound used in

Exp. No. 4 IXL and Paris Green and Soap.—1lb. IXL to every 16 gals. of water, and to this paris green added in the proportions of 1 lb. to every 300 gals. of liquid. About 15 lbs. of whale oil soap (we believe soft soap would have been as efficacious) were added to this 300 gals. The IXL was crushed to pieces about the size of a hen's egg and sufficient hot water poured on to cover it. It was then added to the water, as well as the soap, *which latter has first been thoroughly dissolved.* The paris green was then added and *the mixture kept stirred when spraying.* We have always found it expedient to mix the paris green with a small amount of water first (if it is of good quality it will readily mix) and then pour the creamy mass into our spraying liquid.

Two lots of trees were treated with this, one receiving the first spraying May 26th another June 15th. Both lots made a very good showing, those last sprayed appearing as well at the end of the season as the former. The cost of labor and material in this experiment was 7 cents per tree (35–40 years old) for each spraying.

OBSERVATIONS ON THE LIFE HISTORY OF THE MOTH. MISCELLANEOUS NOTES, ETC.

A diligent study has been made of the length of time occupied in the different stages of the life of the codling moth. In the Fall of 1891 a breeding-cage was placed out-of-doors, in a situation where it could have, as nearly as possible, the same natural conditions, as regards temperature and moisture, as the insect would be subjected to during the winter in its natural habitat. In this cage several cocoons were placed.

From May 16th to May 26th, 1892, moths emerged from these cocoons very rapidly. From these, from specimens subsequently secured, and from observations in the field, the following data have been conclusively determined: *Life of moth 10 to 15 days, pairing and egg laying taking place during the latter part of that time, after which the moths die.* The eggs are semi-transparent cloudy white with yellowish tinge, the shell finely sculptured (see Fig. 1 Plate 1) from 1-fifteenth to 1-twentieth inches in diameter, and are plastered on the surface of the apple. Each female moth lays a large number of eggs, but apparently only a certain proportion of these eggs develop, as many were found flattened and dead, looking like small trout scales on sound apples. *The eggs hatch in from 5 to 10 days.* The larvæ when first hatched are hardly a twentieth of an inch long, and, in the cases

under observation, broke or ate their way through the shell, and entered the apple somewhere else than at the spot occupied by the egg. I cannot say however that they do *not* eat *directly into the apple without breaking the shell*. The life of the larvæ in the apple lasts for *about 4 weeks, or a little less*, at the *expiration of which time, they leave the apple and remain in the pupa state three weeks*, when they emerge as moths ready to repeat their destructive work. The last brood in the Fall, however, do not leave the cocoon until spring, remaining as larvæ in their silken nests throughout the winter. It is a noteworthy fact that the eggs of the first brood are not necessarily laid in the calyx end of the young fruit, as eggs were found the past season, (June 28,) long before any wormy apples appeared, and hence belonging to first brood, *placed on both the sides and the top of the fruit.*

The data above cited should be convincing proofs that the moth is at least four brooded in Oregon. To make this still clearer the above facts are embodied below in a table easily understood.

In order, however, that there may be no room for question we will place the date of the appearance of the first moths on June 1st, at about which time we noticed moths in the orchard, four days after their appearance in the feeding cage. The columns are lettered A. B. C. D. E. Series A is continued under C. Series B represents a number of moths which Mr. Coote brought us from his apple room June 20th.* Series B is continued under D, and C, which is continued from A, is concluded under E.

	A	B	C	D	E
Moths emerge from cocoons.....	June 1	June 20	Aug. 9	Aug. 28	Oct. 17
Egg laying (when moths are about 10 days old.)	June 1	June 30	Aug. 19	Sept. 7	Oct. 27
Hatching of eggs (5–10 days.)	June 21	July 10	Aug. 29	Sept 17	Nov. 6
Life of larvæ in apple (4 weeks.)	July 19	Aug. 7	Sept. 26	Oct. 15	Dec. 4
End of larvl and pupal stages in cocoon (3 weeks) and emergence of Moths.	Aug. 9	Aug. 28	Oct. 17	Nov. 5 or the following spring.	Emerge the following spring.

The extreme length of the different periods has been used in the table, in order to show how easily four broods can appear during our long warm season. These broods by no means appear with regularity, but there are evidently many individual variations; some eggs hatch more quickly than others, some larvae mature more rapidly than their fellows, or some eggs may be laid a few days earlier or later, according to circumstances. It is evident that there is, consequently, considerable irregularity in the appearance of the moths. But the data upon which the above table is constructed are correct, and the dates given are as nearly exact as circumstances allow.

As to the larvæ which leave the apples about Oct. 15th, it cannot be said with certainty whether they all emerge from the pupa stage Nov. 5th or live in their cocoons as larvae during the winter, passing through their

* All apples had been removed from this room in January; the moths, therefore, which had pupated in cracks in the floor, were from a late brood of the preceeding season. They were unworn and apparently just emerged from pupa cases.

transformations in fruit houses and store rooms. The finding of a moth out-of-doors as late as Nov. 15th indicates that some, at least, pass through their transformation in the Fall.

There is no question but that the larvæ which enter the pupa stage Sept. 26th (column C) transform into moths the same season, and begin a life cycle which is completed where the apples are stored. Boxes and fruit houses which have contained unsprayed apples, if carefully examined toward spring will disclose, in cracks and crevices, hundreds of cocoons containing larvæ. That there is a marked overlapping of broods in the Autumn, an increasing abundance of the pest and a consequent serious damage to fruit at this time is shown by the finding of apples in Sept. and Oct, with full grown larvae, larvae a week or less old, and others of intermediate ages. This same discrepancy in ages of larvæ has been observed earlier in the season, all indicating the irregularity of the appearance of the moths and the variation in time required by the eggs to hatch etc.

The first brood of moths here, those earliest on wing, do not appear to affect the pears. This same thing has been observed in some of the Eastern States.

Sept. 18 1892, an egg, apparently fresh laid, found on Duchess pear.

Shortly before, upon, and a few days after Oct. 18, cocoons were found under bands on trees containing larvae which did not change to the pupa stage while under examination, evidently destined not to complete their transformation until the following Spring.

A few apples upon which occurred eggs were allowed to remain a few moments in the IXL, paris green and soap solution, but subquently these eggs hatched. This would seem to indicate that the solution deos not affect the egg itself, but cannot be regarded as conclusive. The young larvae, in the cases observed, invariably left the shell as stated before, entering the apple at some other point. If such is always the case, they are, in properly sprayed apples, certain to get some of the poison.

In some instances an egg or eggs were found on apples in which immature larvae had already been found. There would be, then, later, two or more larvae in one apple at the same time.

We have just tested some whale oil soap made by the Arctic Oil works and for sale by The Blumaur Frank Drug Co., Portland, at 7 cents per lb in small lots. We find it to be 80 per cent soap, dark and firm and presume it might be purchased for a little less if obtained in large quantities.

We have used at the Station a soap sold by the old firm of Taylor Nasen and Co., San Francisco, for which we pay 3 cents per lb. in 400 lb. lots, and which the manufacturers claim to be pure whale oil soap. It has answered our purpose very well, yet evidently contains more or less water,—it has not the firmness and solidity of the first soap mentioned.

Summarizing.

Observations on the habits of the moth, extending through three years, together with last seasons investigations, have convinced me that orchardists begin spraying altogether too early. The absurdity, as well as the danger to bees, in spraying the bloom, has been clearly demonstrated before

this, and it is very evident that the first spraying need not be given until quite a time after the bloom has fallen. This theory is borne out by last year's work in which trees sprayed for the first time with IXL and paris green and soap as late as June 15th compared very favorably with those first sprayed May 26th. Had we sprayed last season anytime between June 1st and June 6th we should have regarded it as early enough. Last season was rather backward, yet we shall govern our actions this year by last year's observations, spraying possibly a little earlier or a little later than June 1—6 as circumstances seem to dictate.

Inasmuch as the IXL, paris green and soap gave the best satisfaction last year, apples going three and four weeks between sprayings, we shall try the same thing in the same proportions this season, spraying for the first time as indicated above and allowing three weeks (granting it does not rain heavily immediately after a spraying, when it might be necessary to repeat) to elapse between the first and second and second and third sprayings. To another lot of trees a fourth spraying will be given, four weeks after the third. It is possible that the late apples may need this, but it is believed, if the trees sprayed are at a distance from neglected orchards, or if all orchardists in a neighborhood will co-operate in the good work, that three faithful treatments will bring very good results.

While we are hardly prepared to indorse all that the manufacturers of IXL claim for it, and while this coming season's work may refute entirely the good results obtained last summer, we are inclined to believe as far as we have seen that it is a good agent in the hands of orchardists. The apple scab (*Fusicladium dentriticum*) was less prevalent on trees where IXL was used (though this must not be regarded as conclusive evidence of its effectiveness in that direction) and the branch form of Woolly Aphis was kept completely in check, a little extra time being taken, when spray- for the codling moth, to direct the spray forcibly against the colonies of this pest.

Banding, *i. e.* wrapping a strip of old burlap about the tree has proved a most valuable adjunct to spraying and will be practiced this season; the bands will de examined every five or six days and the larvæ found beneath will be killed.

Pears evidently do not require any spraying until about the time the second brood is on the wing.

From two to three gallons should be enough liquid to spray a tree from 30 to 40 years old, smaller trees requiring less.

This department has found that Paris Green gives the best satisfaction, and the experience of Eastern workers appears to corroborate this, yet many orchardists in Oregon report in favor of London Purple.

Our storerooms and fruithouses are veritable nurseries for this pest, and send out hundreds of volunteers every Spring. This is overcome in some sections by having gauze over the window or windows and catching and killing the moths in their efforts to escape.

If the orchardist is over anxious as to the efficacy of only three spray-

ings, or thinks his first spraying has not been thorough, he might safely interpose a spraying ten days after the first.

As stated before 7 cents per treatment will cover the expense, both labor and material, of using the above mixture on large trees.

The later we can safely spray for the first time, the less likelihood of interference by rain.

EXPLANATION OF PLATES I AND II.

Fig. 1, Pl. I, is the egg of a Codling Moth, enlarged about 70 diameters. It was made from a photograph of a camera lucida drawing. The egg is nearly ready to hatch and the embryo larva can be seen beneath the shell.

Fig. 2, Pl. I, is a photograph of a few pinned insects, natural size. The two upper left hand specimens are Codling Moths. Many of our farmers have no idea of the size and appearance of this pest. One of these moths is figured with expanded wings, the other with wings folded.

The clear winged, wasp-like looking moth on the right, the last figure on upper line is the imago of the Peach Borer, *Sannania Pacifica* (Riley), whose eggs hatch into the worm we find in our peach, plum, and prune trees.

The first four insects in the lower line are *Hippodamia convergens* (Guer.) or "Lady Birds," beneficial beetles which consume, with the aid of their larvae, hundreds of Woolly Aphis, Hop Lice, Green Aphis etc. The last beetle on the right in the lower line is an injurious form known as "The 12-spotted Diabrotica" *Diabrotica 12-punctata* (Oliv.) and in size and appearance it looks not unlike the "Lady Birds," but its habits, of course, are entirely different.

DESCRIPTION OF SPRAYING OUTFIT IN USE AT THE STATION.

Plate II illustrates the apparatus with which we spray, A galvanized iron tank capable of holding about 160 gals. is fastened to a frame made of 2×12 plank, which in turn is hooked on to a wagon bed. When it is necessary to use a warm solution, a sheet iron stove is fitted under the tank, its door flush with the rear end. The smoke stack from this runs forward, below tank, out through a hole in the frame at the anterier end, and ends in an upright piece about 5 feet long (not shown in plate).

We use a Beam Pump No. 5 and it gives good satisfaction. Its receiving hose screws onto a faucet leading from the anterior end of tank, and its two pieces of discharge hose are connected with bamboo extensions as shown in cut.

A wooden cover fits tightly on to tank in the centre of which is a wide slit two feet long, through which a paddle is inserted and the liquid kept stirred while being sprayed. A good and cheap improvement on this method of stirring, which we propose to adopt, is to have a series of paddles, hung from the cover, all worked by a lever which the driver could occasionally push back and forth. When not in use this tank fits into a brick furnace, and is used for compounding any insecticide which requires heat. A desirable addition, which we have not yet arranged, is a tackle to hoist the tank, when full, from off the furnace, and to roll it on to wagon bed.

PLATE I.

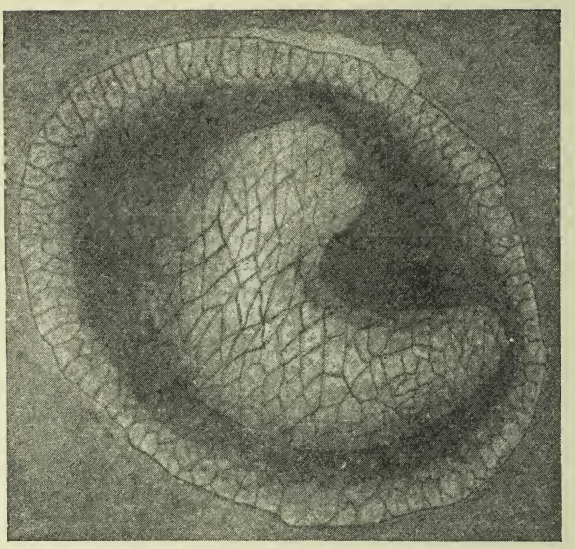


FIG. 1.—Egg of Codling Moth, much enlarged. (Original.)

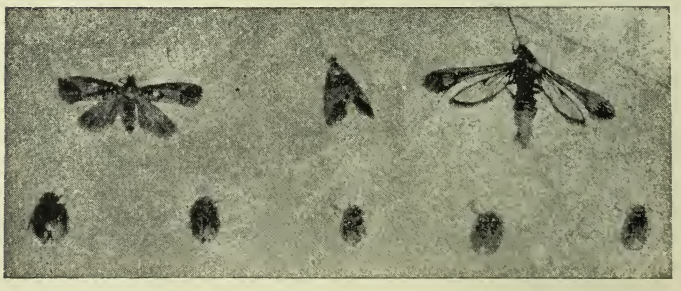
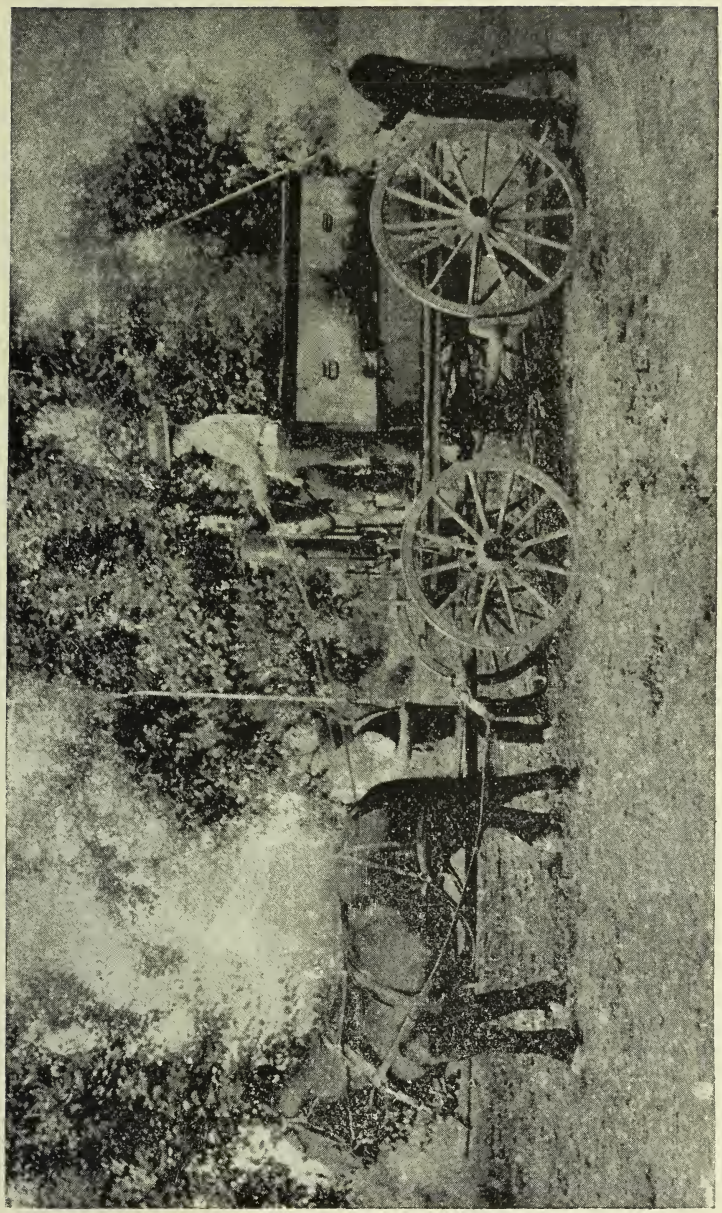


FIG. 2.—A few pinned Insects, natural size.

PLATE II.



THE HOP LOUSE.

(*Phorodon humuli.*—Schrank.)

Part of bulletin No. 10 from the experiment station issued in April 1891 was devoted to this subject, giving the life history of the pest, observations on its habits etc. in Oregon, preventive measures and remedies.

Since that was written reports have come from many hop growers of the state corroborating the statement that wild plums, or seedlings, and, in a few instances, a very few,—cultivated plums and prunes were the place of deposit of the eggs which last through the winter and hatch in the spring The migration of the hop louse from plum to hop and hop to plum is not now questioned by observant growers notwithstanding the opposition which this statement met with two years ago.

On p 32 of Bulletin No. 10 methods of prevention and remedies were given, viz. (*a*) clearing away superfluous timber about yards, letting in sun and breeze; (*b*) cutting and burning all thickets of plum seedlings, wild plums etc. in the vicinity of hop yards; (*c*) avoiding importation of eggs on plum scions from localities infested with hop louse; (*d*) cutting and burning the vines directly after picking; (*e*) spraying, to kill eggs, any valuable plums or prunes upon which eggs occur, with strong caustic solutions, when the buds are dormant; (*f*) spraying the same trees in Spring and Fall while the louse is found thereon, using any of the sprays recommended for Summer treatment against plant lice; (*g*) spraying the hop vines themselves during the summer season with any of the following standard solutions hitherto suggested, viz., Quassia and Soap, Kerosene emulsion, Tobacco and Soap.

Further study of this subject during the two years elapsing since the above was written has brought out some points of especial value to hop growers and the object of this treatise is to present, in a brief form, these new facts. There is no hop yard at the Station or in the near vicinity, and much of this information has been obtained by visiting yards, and talking with growers. Our thanks are due Mr. T. D. Linton, Mr. G. Muecke, Mr. Bents, Mr. Reuben Wright, Mr. S. Smeed, and others for various courtesies.

No reason has been offered for in any way changing the recommendation given under (*a*) above, it being a noticeable fact that hops planted on the uplands are freer from lice than those in river bottoms. We still recommend (*b*) as in a measure, abating the evil, but it should be borne in mind that this insect while in the winged form, may migrate or be carried by the wind a long distance from the hops hence this measure is only part of the work and does not afford complete exemption. No comment is needed on [*c*], its value is apparent. Regarding cutting and burning the vines directly after picking, [*d*] much can be said. The most contradictory reports have been received relative to this practice, which in some places is in general use. Some of our growers claim that if cut high enough [about 3 or 4 feet] and tied at the end, no injurious results follow and others assert that whenever and wherever cut, the crop of the following year is injured and may be a failure. *The weight of testimony appears to be decidedly against cutting, even when lifting out the poles*, careful workers asserting that the

pole can be rotated in such a way that it can be slipped up through the coiled vines, only necessitating the possible cutting of one or two stems. Further, we are privileged to illustrate and describe a method of trellising a yard which does away with the necessity of using poles, and consequently of pulling them up. The burning of vines, immediately after picking is, of course, to kill the lice before they may have migrated to the plum where they pair. It should never be done on the yard, and, if the measures recommended elsewhere for summer use, are carefully carried out, it may be postponed to suit the convenience of the grower.

The propositions [*e*] and [*f*] need no comment, they hold good anywhere and their use is regulated by the judgement of the growers. Spraying the hop vines themselves during the summer season [*g*] is the only true resource of the hop grower and all progressive hop men unite in saying that they regard spraying their hops as much a necessity as their cultivation and that in estimating their year's expenses, the cost of spraying is always included. All other preventives catalogued are of little value if the grower thinks he can thereby avoid spraying the vines during the summer. They may alleviate the evil to some extent, but it would be folly to rely upon them alone.

Granted then that spraying the vines during the summer is a necessity, and it surely is, the question arises, "what material have our hop growers found most efficient"?

Kerosene emulsion was one of the spraying solutions recommended in Bulletin No. 10; it has been used in the East on hops and to some extent on this coast, and is one of our most efficacious insecticides for plant lice. Kerosene however, as the reader knows, is fatal to vegetation, and to properly compound the emulsion requires great care. Its efficacy depends so largely on its proper manufacture, and there are so many chances for an unprofessional to make a disastrous error in its preparation and use, that growers, in view of safer compounds, should be cautioned against it. It should not be used when hops are in bur. Conversation and correspondence with very many growers lead us to say it is *not a safe insecticide in the hands of our hop growers.*

Quassia and Soap.—This is highly spoken of, and barring the expense of the chips and the time consumed in extracting, is recommended. Quassia chips are for sale by parties here and in the State of Washington for about 6 cents per lb. Whale oil soap can be obtained in bulk from 3 cents per lb. to 6 cents or 7 cents per lb., the latter guaranteed to be 80 per cent strength.

Tobacco [*stems*] *and Soap.*—This has given such perfect satisfaction, after repeated trials that we unhesitatingly endorse it. Furthermore its cheapness, and the fact that it does not necessarily call for whale-oil soap [though this may be used] but an inexpensive home made soap, makes it a desirable agent. Mr. G. Muecke of Aurora Mills Or., has used it and is delighted with its efficacy. The stems can be used twice and then are valuable as a fertilizer and preventive of grub worms.

The solution should be of such a strength that the liquid has a decided tobacco color. Strain after steeping. Add enough soap [cheap soft soap or

whale oil soap] to make the liquid spread evenly over the leaves. Mr. M. states that in England tobacco is recognized as better than qnassia in this direction, but that there tobacco is more expensive; here the tobacco is the cheaper of the two.

Two cents per lb., is charged at factory in Corvallis for waste tobacco stems, and presumably the price is the same elsewhere.

The supply from these sources is limited and Mr. Muecke has agreed to sell tobacco stems [gathered up from various sources in San Francisco] for 3½ cents per lb., as long as the supply in his storehouse lasts. This figure, which covers the cost of transportation from San Francisco to Aurora Mills. is nominal compared to the cost of quassia.

Wm. Brown of Salem sells quassia chips made here from quassia logs shipped from New York, for 6 cents per lb., and whale oil soap which he guarantees to be 80 per cent., for 6 cents per lb. He is also agent for the Roberts' Roller Sprayer.

Regarding apparatus for spraying, the growers must be guided by their preferences. The Bean Pump, maunfactured by the Bean Spray Pump Co. at San Jose California is highly spoken of, and the experiment station can indorse this pump for general use. The Mitchell Lewis & Staver Co are agents for this pump, the difierent sizes selling all the way from $16.00, to $54.00, In California the Champion Spray Pump also meets with approval sold by Woodin & Little S. F.

The Puyallup Roller Sprayer sold by Meeker & Co. of Puyallup Washington, and the Roberts Sprayer made by Roberts of the same place, both working by horse power, are advertised. We cannot, at this date. speak of their comparative merits.

MISCELLANEOUS NOTES.

Young lice on the lower surface of leaves if exposed to the rays of a hot sun, quickly die. A number of growers taking advantage of this, pick the lower leaves when first infested and leave them on the ground, *their undersides uppermost.*

A number of prominent growers report very favorably on the use of sheep in the hop yard. They must be removed as soon as they have eaten the lower leaves and begin to paw the poles in their efforts to reach the foliage above them. If they are not disposed to eat hop leaves at first, one grower suggested picking a few leaves, sprinkling them with a little salt water, and then feeding. The sheep soon acquire a fondness for the natural leaf.

The time for the first spraying is when the lice first appear in the yard. Growers should, therefore, watch the vines for the first evidences of the presence of the pest.

In no instance has a genuine hop louse been sent to the Station from any other plant than a hop or plum or prune tree except a few sent by S. A. Clarke of Salem on mint leaves. This mint however grew among plum or prune trees which were infested, and the occurence on the mint may ave been accidental.

Hop lice which were found on Petite prune have been sent to this department in a few instances. The Italian prune has not been touched as far

as is known. The louse does not remain on any plum or prune tree long enough to cause appreciable injury.

Mr. Smeed of Waterville writes that the German Grape and English Cluster have been badly infected. He has three varieties of early hops ripening from 10 days to 2 weeks before the English Cluster. It has never been necessary to spray these, though adjoining infested yards of other varieties.

The following diary memoranda may be of interest:

April 12, 1892.—Many Green Aphis [*A. mali*] sent in from two localities under the impression that they were the hop louse.

May 16.—Genuine hop lice received from T. D. Linton of Eugene found on Blue Plum: Mr. Wells of Buena Vista reports winged hop lice on his hop vines. Specimens were sent, and proved to be *Siphonophora* and not hop lice.

May 18.—Specimens of hop lice received from Capt. Wuestney Napavine Wash., found on an unnamed plum tree.

May 27, 92.—Winged and wingless hop lice received from Salem Or., found on Plum trees.

June 1, 1892.—Specimens of hop louse received from T. D. Linton of Eugene, found on Hop Vines. The above dates indicate the time of migration from plum to hops.

Mr. B. Grimm of Aurora finds IXL in the proportions of 1 lb. to 10 gals of water a good wash for the hop vines. Capt. Wuestney of Napavine Wash. speaks highly of its effect on the vines. He reports unfavorably of the Woodbury Tree Wash. G. Muecke of Aurora also reports unfavorably on Woodbury Tree Wash as far as hops are concerned.

Mr. Alec. Holmes of Derry Or. is reported as finding chittim-wood bark(*Rhamnus*) as good for hop lice as quassia. Another party claims that the vegetable pest known as "Man-in-the-ground"(*Megarrhiza Oregona*) is a good remedy. We have had no opportunity of verifying this.

Too early picking, occasioned by the attacks of vermin, apparently injure the vines. This seems especially true of the German Grape and English Cluster varieties.

Mr. Muecke states that he "sprayed with the tobacco solution up to picking time, and that after the hops were dried and baled various experts could find no trace of tobacco smell."

A TRELLIS FOR HOP VINES.

Through the courtesy of Mr. Reuben Wright of Mulino Or. we are enabled to present the following figure and description of a method of trellising which he has adopted in his yard. The principle is not new, though some of the details may be innovations.

The advantages of this method over the old system of poling are apparent; the growth is more even; at least one third of the spraying material is saved; in picking, the two wires are raised off the pins with a pole, and they then are low enough to pick all the burs, there is thus no need of loosening the ends.

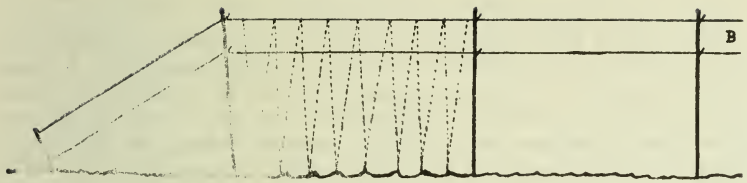


FIG. 3.—A Trellis for Hops.

Explanation of figure:—A is placed on surface of ground and by the side of an anchor post. This anchor post is 6 in. × 6 in. and 7 feet long, 4½ feet of this being below the surface, and it inclines at an angle of 35 degrees. The anchor post is 10 feet from first support and has its counter part at the other end of the row. Supports consisting of cedar, each equal to a 4×4 in size, are placed between the two anchors, nine hills intervening between every two supports (only eight are indicated in the fig.) The support nearest the anchor leans slightly. Each support is 11 ft. long, 2 ft. being below the surface. Six inches from the top of each support a ¾ in. wooden pin is inserted, slanting enough to hold wire securely.

Thirty inches lower down is a similar pin. As indicated in the figure there are two galvanized iron wires, the upper one size No. 12, the lower No. 13; the letter *B* is placed between the wires. The dotted lines in figure represent common cotton twine, two strings from each hill fastened to the two wires. About five pounds of this twine is used to the acre.

The method of raising the wires and stringing is as follows: the supports and anchors in, and the wires stretched through the yard, a ten penny nail is driven into each support five feet from the ground and another one thirty inches lower down. The wires are then fastened to anchor post at one end, raised to the nails, the upper wire lying on the upper nail, and the lower on the one below. The wires are then pulled as tight as possible and wrapped around the anchor post at the other end. The twine is cut into pieces ten feet long. Two of these pieces are used for each hill (see dotted lines in figure) each piece being passed round bottom wire once and tied firmly to upper wire. After the row is strung raise the wires to the wooden pins, and stretch tight, the tighter the better. A fir splint six inches long is driven into each hill, after the strings are fastened to it, by two half hitches. These strings should be taut from hill to wires. The twine costs 90 cents per acre, No. 13 wire costs $15. per acre. The cost of the timber for anchors and supports and splitting and hauling differs, of course, with circumstances.

Mr. Wright will doubtless be willing to answer any further inquiries regarding this trellis.

GOPHERS AND MOLES.

"Well said, old mole! cans't work 'i the ground so fast?"

The order of animals known as Rodentia or "gnawers" comprises a very large share of that portion of the class of *Mammalia* which is found in North America. The order is characterized by the presence of chisel-like incisor teeth in the upper and lower jaw with which their gnawing is accomplished. Our rats, mice, squirrels, marmots, rabbits, and gophers are examples of this order and illustrate this dental characteristic.

The Pocket Gophers or Pouched Rats, prominent rodent pests, occur in a family called *Geomyidae* and are widely distributed over the United States. The special individual which occurs in such destructive abundance on this coast, and forms part subject of this sketch is *Thomomys bulbivorus*. Against this pest and against our common mole *Scapanus Townsendii*, which is also so unfortunate as to be regarded in an unfavorable light, this department has worked for the past two years endeavoring to find remedies which would afford, at least, some relief.

The mole does not belong to the same order as the gophers, its habits are different; structurally it is widely different, and its small sharp teeth all much alike, seem especially adapted to crushing and masticating insects, grubs, worms, etc. In fact it belongs to the order *Insectivora* which means "insect eating." The mole's reputation among scientists as a non-vegetarian has been for a long time so firmly established, that any charges of its eating roots or bulbs or seeds has been emphatically denied. This belief in the mole's innocence was entertained by many of our leading workers in this class of animals, and it would seem now, in spite of unfavorable evidence, that, apart from the unsightly mounds on our lawns and the disarrangement of soil in our flower beds, and even admitting his occasional fondness for peas and bulbs, that he cannot be placed in the same category with the pocket gopher, and merits clemency of treatment at our hands. Yet the decree having gone forth that the mole is a pest seals his fate as far as human intention goes and hence we seek for means of killing him.

To return to the Pocket Gopher. Their mounds are familiar to almost every resident of the State.

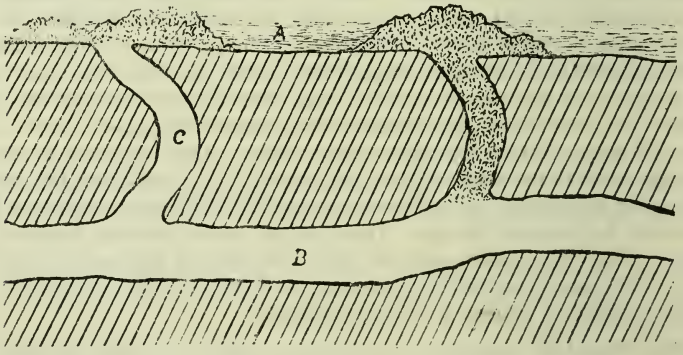


FIG. 4.

Fig. 4 illustrates, diagrammatically, a burrow of this species. B is the main run way from 12 to 20 inches below the surface A. C is a branch burrow from main runway to surface, affording a means of getting rid of the excavated earth. This branch is represented as still open: to the right is another, which, having served its purpose is plugged with earth, the mound on top marking its location.

The plan of the mole's burrow is exactly the same except that the main runway may not be as deep, and in addition to what is shown in Fig. 4 there frequently is an additional burrow close to the surface, forming that characteristic ridge often seen on our lawns and among our garden plants. Furthermore we have never found a mole's branch burrow open, except where it has been made beneath the snow; upon the melting of the snow the open hole is seen. This characteristic, even if there is no ridge caused by the surface burrow, will at once enable one to tell whether he is troubled with a gopher or mole, for the last made branch burrow of the gopher is often open, and in fact at certain hours in the day the occupant may be seen thrusting his head out, while busily engaged in getting rid of the earth which has accumulated within. This the mole does not do, and althongh we often see his mound moving before our eyes and visibly growing larger, the little depredator is concealed below. His minute bead like eyes, concealed beneath the velvety fur, but present nevertheless (this applies to this particular species, these are forms where the integument covers the rudimentary eye) would be of little service to him above ground; indeed it probably avails him very little in his wanderings below the surface, as his sensitive snout and delicate sense of smell are his chief guides in searching for food. As a rule the mounds of the mole consist of more finely pulverized soil than do those of the gopher, but they may be as large or larger than those of the latter. The burrows of the mole are, of course, smaller than the gopher burrows.

The first figure in Plate III at the end of this article is a male pocket gopher, dorsal view; the second is a female ventral view, and showing on the sides of the head the characteristic pouches (not connected with the mouth) opening below. This depredator often leaves its burrows at night on foraging expeditions and at this and other times when collecting food below ground these pouches are used as pockets in which the food is carried. Some observers state that the earth which is brought up from the main burrow is largely carried in the cheek pouches, while others flatly contradict this, asserting that the soil is pushed ahead of the animal. Both statements may be correct, we have never found any proof that they use the pouches as earth carriers. Both gophers and moles are active here during our winter season. The breeding season of the mole is early in this state, my diary states that on Feb. 28th of last year a pregnant female was captured containing three well developed embryos, and two days later another was captured with two embryos apparently within a few days of birth. I have, as yet, been unable to secure a pregnant gopher and hence cannot speak with accuracy of the exact date of their breeding time, but from the fact that I have caught one meadow mouse (*Arvicola*) Mar. 10 with six nearly

full grown embryos, and since I have been unable to catch any female gophers at about this date, Feb. 15th to Mar. 15th approximately, I infer that the breeding season, that is for the first litter, is nearly contemporaneous in the three types mentioned. It is very evident that the best time to destroy them, if possible, is early in the season before the birth of the first litter.

The pocket gopher has not a little intelligence. Our horticulturist reports finding a nest stored with potatoes, the tubers lying in layers, and each layer separated from the adjoining layers by more or less dried grass. Furthermore the entrance to this nest, or at least one entrance, was from below, affording a system of drainage quite desirable in this country of wet winters.

It is a common thing to see gopher mounds arranged in a straight line from the side of a field or garden to some fruit tree or potato, parsnip, or carrot patch, indicating that his main burrow beneath the surface has been pushed directly to these sources of food supply.

REMEDIES FOR THE POCKET GOPHER.

Poisoning:—We have introduced powdered strychnine into pieces of potato an inch square and placed this bait down the branch burrow, or even as far in as the main burrow, with fair success. We have never had conclusive evidence that the animals were poisoned, except that digging ceased in that neighborhood which was pretty convincing proof that the strychnine had done its work.

This has proved most effective in the absence of other succulent root crops which may be more tempting to the gopher. And inasmuch as he may push out the bait with a lot of earth, before he fairly reaches it, it has been found best to put into the burrow more than one piece.

It goes without saying that *stychnine, being a deadly poison, should be kept under lock and key*, out of the way of children and others ignorant of its use.

Wakelee's Poisoned Wheat is claimed by some to be not only efficacious against the so-called "Digger Squirrel" but to be also a good remedy for the pocket gopher. If this is so, it must be at times when other more juicy food is scarce.

Shooting:—A handy shotgun is very effective. The pocket gopher works during the night, and is quite likely to be found digging *early in the morning, again about noon and again late in the afternoon.* At these times he frequently thrusts his head out of his hole and a few pellets of shot will kill him.

But the farmer or the orchardist can not afford to spend time in watching gopher holes, and their best resources are poisons and

Traps:—There are many so-called gopher and mole traps on the market but apparently very few which can be profitably purchased.

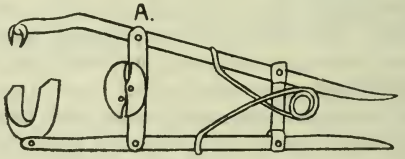


FIG. 5.

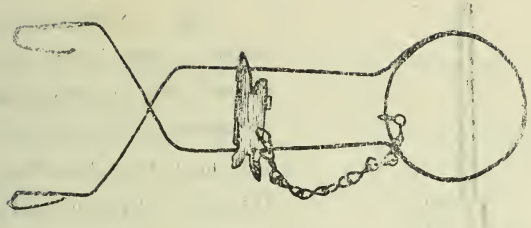


FIG. 6.

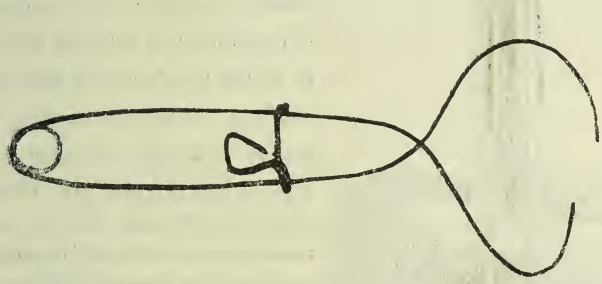


FIG. 7.

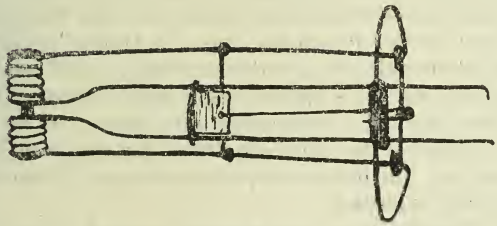


FIG. 8.

Fig. 5 above shows a gopher trap which has been on the market a number of years. Fig. 6, 7, and 8 represent other traps (all set), costing at retail 25 cents each. Specimens of each were donated the station for trial and we have worked with them for two years and find them of little if any value. A few young, undersized gophers have been caught, but it has almost invariably happened that the wily rodent has covered them up with earth, or possibly, in a few instances, left a few hairs on the points (in the case of the trap shown in Fig. 8) showing plainly that the trap is not strong enough.

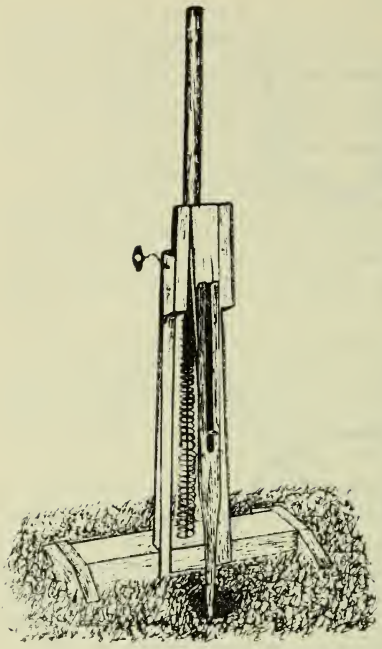


Fig. 9 represents, a trap, which we have found very useful against both gophers and moles. The cut shows the trap set for a gopher. It is made by John Picard, St. Paul Marion Co. Oregon. and this particular trap we purchased from J. B. Mount Newberg Oregon for $2.50. This is too high a price, and the maker could increase his sales ten fold if he would sell them at a more reasonable cost. Numerous letters to Mr. Picard relative to this point elicit no reply whatever and Mr. Mount has recently written us that he has not seen nor heard from the manufacturer, whom we understand is a farmer well known in that locality, for some time.

FIG. 9.—The Picard Gopher and Mole Trap.

DESCRIPTION OF PICARD TRAP AND DIRECTIONS FOR SETTING.

It is about two feet high. Through the base-board runs a brass spear, which is fitted into the lower end of a wooden rod, the latter working up and down in a hole in the top of the trap. A triangular piece of iron (shown attached at one side in cut) serves as a trip bar and when the trap is set keeps the spear up and is lightly caught under a piece of iron on the trigger which latter (see Fig.) swings easily on a hinge. As shown in figure a sliding piece, pointed at the end is attached to the trigger and can be adjusted to any length- The downward pull on the spear is brought about by a strong brass spring as shown.

In setting, a branch burrow which is open is found (C. fig. 4) or one is opened with a trowel, and the spear forced down *perpendicularly* through the soil, about six or eight inches from opening, *so that it passes directly through the center of the burrow. The base must lie squarely on the ground The spear is then worked several times up and down through the soil, that there may be no binding when sprung.* Before setting, the pointed end of the trigger is worked back and forth, to see that the soil does not impede its movements. The point should be within an inch of the bottom of the mouth of burrow.

A stone or heavy clod of earth is then placed on the base on each side to keep trap steady when sprung. The wooden rod is then raised, the trip bar adjusted and the trap is set.

The principle is this: the gopher will sooner or later stop up this branch burrow. Or, seeing the pointed stick at his doorway, he at once proceeds to push out a lot of earth to protect his domicile from what may appear a sus-

picious object. The earth pressing against the trigger point, springs the trap, and the gopher, behind the earth, is speared.

We have used this trap successfully against both gophers and moles. What failures we have met with have been attributed to not gauging correctly the distance between trigger and point where spear enters burrow. In one instance, when the trap was set in a patch of peas, the gopher pushed against the trigger himself, issuing from his hole to nibble the delicate bait close at hand, and it was not until the above distance had been shortened, that he was captured. One can dig to the main burrow (*B. Fig4.*) and set the trap there. But in this case it is generally impossible to tell from which direction the gopher will come, and a second setting may be necessary. By introducing a small bit of wood above the screw between the sliding part of the trigger and its upper part, an angle may be made between these two parts, and the lower point thus brought nearer the course of the spear. It has been found necessary to do this in setting the trap for moles.

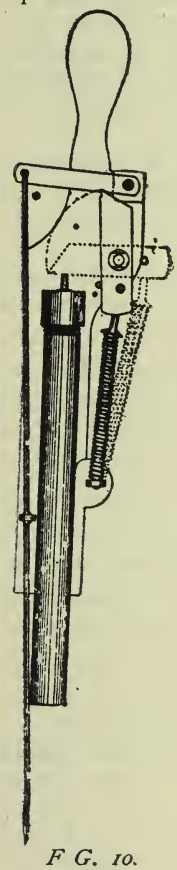


FIG. 10.
(Go[illegible]r Gun.

Fig. 10 shows another trap which we have used against both gophers and moles with success. It is represented as set. It is, very efficacious, and though requiring more care in setting than the Picard trap, there are probably less chances of failure when the details are carefully attended to. This trap is about 16 inches long and no description is necessary. It is of course, a fire-arm, *and as such has to be handled carefully.* It is for sale by O. Dickenson of Salem Oregon for $4.00. He states that he will have the exclusive sale of these traps for the next four years, and that the inventor has applied for a patent. It is needless to say that we regard four dollars as a very high price for this gun. Undoubtedly lessening the price would increase the sales. The agent states that during a single season, with one gun, he has killed nearly a hundred gophers. It is certainly very killing. In setting, the earth should be so hollowed out with a trowel that the muzzle, which is placed 4 or 6 inches down the burrow *lies directly in the middle line, the barrel parallel to the long axis of the burrow; the gun should lie squarely on the ground, and care should be taken to see that the wire plays freely back and forth.* On the point of this wire is firmly placed some object to blunt it, a piece of wood, or small cork, or better, a small piece of carrot, potato or parsnip. *Only a small charge is necessary, a thimble-full of powder, and twenty pellets of No. 3 shot will do very nicely.* A water proof cap is fitted tightly to the nipple, the hammer is drawn back and caught. This applies to the branch burrow, which has either been found open or has been opened with a trowel. It is set in the main burrow in the same way, but, as in the case of the previous trap, there is an uncertainty of the direction of the gopher's approach. The animal, in pushing the earth before him, literally shoots himself.

Remedies For Moles.

The last two traps described have worked very well with us. When used against moles they are set in the same way as for gophers. The branch burrow of the mole is always closed, that would therefore have to be opened; and as this burrow is shorter than that of the gopher, the muzzle of the gopher gun cannot be thrust down so far, *it projects into the hole only an inch or two*, that the mole (and the same thing applies to the gopher) may be fairly in the branch burrow before the gun is discharged.

In setting the Picard trap for moles the distance between the lower point of the trigger and the point where the spear enters the burrow, *should not exceed four or five inches.* This is effected by the introduction of a small bit of wood, as above described, between the two parts of the trigger.

Poisoning:—At the suggestion of a party who had been experimenting on a mole in confinement, we tried poisoning small pieces of beef with powdered strychnine, opening the burrows, introducing the bait as far as possible with a spoon and then covering with earth again. In a number of cases where this was done, digging ceased, but not in all. It would seem that the scarcity of their natural food, or its abundance, would affect the efficacy of this method.

Other Means of Killing:—When one is so fortunate as to observe the soil of a mole's mound moving, indicating that the depredator is at work below, a well aimed thrust of a fork will frequently be successful in transfixing the hidden animal.

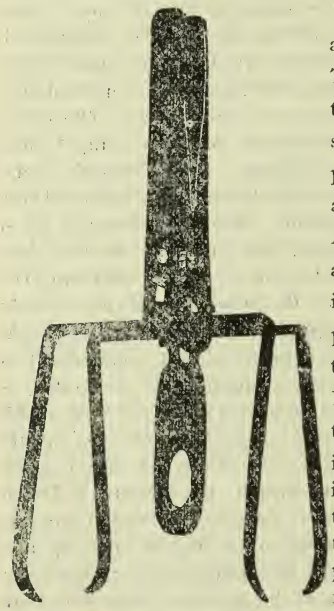


FIG. 11.

Fig. 11 illustrates a trap modelled after an English pattern. It is represented as set. There should be teeth filed in, or soldered to, the inner edge of the jaws, and the steel spring should be very strong. The centre piece, which hangs down between the jaws and keeps them spread apart, is the trigger. Almost any blacksmith can make this trap at little expense, and we believe, with the two improvements above-mentioned, which improvements are found on the English trap, that this would be a killing instrument. In setting, the main burrow is cut into and into the cut is inserted the trap in the position indicated in the figure. The opening above, is covered with dried grass or other rubbish to keep out the light. One party reports that he fills in the hole, in which he has placed his trap, with soft earth, and rarely fails to catch the mole as it is digging its way through the yielding obstruction.

PLATE III.



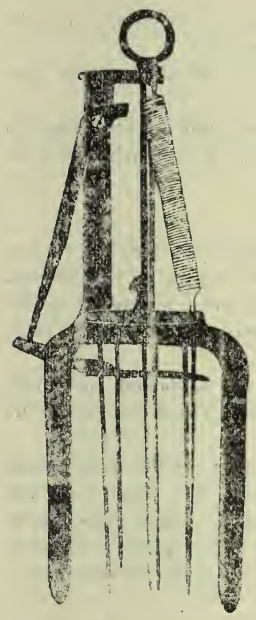


FIG. 12.

Fig. 12 represents a mole trap which is intended to be so set as to spear a mole as it runs through the *surface burrow*. When a newly made ridge is seen, the trap is pressed into the ground in such a way that the two heavy iron pieces on the side straddle the ridge, and the pointed wires project through the burrow. These points are then raised, the ridge slightly flattened beneath them and the plate, which connects with the trigger, lies on top of this flattened surface. The mole in forcing its way through the burrow, raises the plate, springs the trap and receives the pointed wires. We have not tested this trap sufficiently to warrant an expression of opinion upon its merits.

"The California Ground Squirrel." "Digger Squirrel." "Gray Gopher."

Spermophilus beecheyi (Cuv.).

Our wheat crop and fruit trees suffer from this pest which is so well kuown that no description is necessary.

Remedies.—Wheeler's Bisulphide of Carbon is recommended for this rodent. We have not used it.

To prevent "ground squirrels" from gnawing fruit trees, a California orchardist suggests tying newspapers round the tree trunk in such a way that four inches of the paper at the upper edge extends out. The rattling of the paper when the squirrels attempt to cross it will frighten them.

One of the most effective means for their destruction seems to be a trap in successful use in the large orchard belonging to J. H. Stewart at Medford, Or. He places, in fence corners abont his orchard, boxes about one and one half feet square at the ends and about four feet long. The top and two ends are united and can be lifted off the box. The ends do not reach quite to the bottom board, an open space of about four inches intervening, [see Fig. 13], and enabling the animal to run through the box and out at the other end. On the bottom, midway between the two ends, peices of pork rind are securely nailed. These peices have been first soaked in a solution of strychnine, made by boiling strychnine in water. Kernels of corn may be steeped in the same solution and placed with the pork as an additional bait, but is more easily displaced and hence more likely to be eaten by some animal for which it is not intended. But the pork rind cannot be

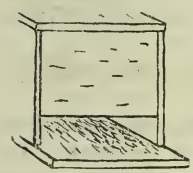


FIG. 13.

removed. The top is fastened on to the box by means of a couple of nails, which can be easily pulled out when putting in new bait.

Mr. Stewart asserts that his trees are free from all attacks of this pest through using this very simple device.

Strychnine is not very soluble in water, but, if thoroughly boiled, enough will dissolve to make a poison. It would seem that if the solution were sweetened it would render it more palatable.

Notes.

The burrows of moles are sometimes found running in patches of carrots, etc., and the finding of a gnawed root in the course of the burrow would seem to implicate our friend with velvety fur, but a species of meadow mouse [Arvicola] frequently uses this passage way and is believed to be the depredator.

In the spring we suddenly find, in localities, in our fields snd meadows, numerous small holes about two inches in diameter. These are made by meadow mice.

A party in Portland Or. who was convinced that moles were eating valuable bulbs, kept three specimens in confinement for some time and fonnd they would eat the following substances: wheat, pears, beef, pork, mutton, and peas. Witnessing one fellow eat the latter quite ravenously was pretty convincing proof to the writer that, under some circumstances, at least, they are not strictly carnivorous.

In this connection we quote from a recent writing of Amos W. Butler of Indiana. Speaking of moles he says, "They generally, if not always, feed upon animal food, insects, grubs, larvæ, earth worms, slugs and almost any sort of animal food appears to be eaten by them. Many suppose them to injure garden vegetables by eating the roots. Such is not thought to be the case usually, however, if at all. They excavate a runway along the row of plants so that they may secure the insects there found, and it is supposed the meadow mice are the forms which utilize the highway thus provided that they may secure a meal of their favorite food from the succulent roots of many plants *I have, however, never been satisfied that the mole, in sandy soil, is not very destructive to young pea sprouts just as they are emerging from the ground.*"

In a number of moles caught in March 1892 the stomach contents consisted almost entirely of finely triturated earthworms, no vegetable matter being present. In one captured in Jan. 93 the stomach contained nothing but a few delicate fibrous roots.

Jack Rabbits, though not belonging under the head of "gophers and moles," are such a pest in parts of Eastern Oregon that they deserve a passing notice.

In some portions shooting them on moonlight nights as they come into the young orchards is practiced.

Pieces of poisoned melon scattered plentifully through an orchard has been found helpful, the rabbits preferring the melon to the bark. Any vegetable of which they are especially fond might be used when melons are lacking. The two following recipes are recommended as making ef-

fective poisons: Add 9 gals. of water to 100 lbs. of wheat. To this add 1 lb. of phosphorous, I lb. of sugar and 1 oz. of oil of rhodium. Bring to a boil and let stand over night. The next morning stir in enough flour to to make a kind of paste. Scatter this over ground frequented by the animals. The second recipe is ½ teaspoonful of powdered strychnine, two tablespoonfuls of fine salt, four tablespoonfuls of granulated sugar. Shake well together in a tin box. If placed on boards this becomes hard and rabbits lick it eagerly.

DESCRIPTION OF PLATE III.

The first figure on left is a male pocket gopher [*Thomomys bulbivorus*] dorsal view. The next figure is a female gopher, ventral view to show opening of pockets on side of head. To the right of the head of this specimen is a small shrew. The shrews are small mice-like animals, shy and retiring in their habits, belonging to the same order as the moles, strictly carnivorous and very pugnacious. They kill and eat many field mice, and not infrequently are given to killing and eating each other.

The large figure to the right of the female gopher is a mole [*Scapanus Townsendii*] and to the right of that two meadow mice belonging to the genus *Arvicola*. The first skull on the left is that of a pocket gopher, the next one that of a mole, and the smaller one on the right that of a field mouse, The picture does not show the difference in dentition between the two orders *Rodentia* and *Insectivora*, for which purpose the skulls were inserted. The female gopher pictured was 9½ in. long and from this the length of the other specimens can be easily computed. The two gophers were taken from specimens in the flesh; the mole was stuffed, as were also the two meadow mice. The shrew was an alcoholic specimen.

ADDENDA

The following notes were made up too late to be incorporated in the body of the text, and through the courtesy of the printer are here appended.

March, 28th, 1893—A pocket gopher just secured, containing four young embryos. See page 15.

From the cheek pouches [not to be confounded with the pockets of the pocket gopher] of a ground squirrel, captured at 10 a. m. on a day in last September, by Prof. F. E Loyd of Forest Grove, 21.1 grams or 50 c. c. of oats were taken, an indication of the amount of damage caused by these pests.

The galvanized iron tank figured in Plate II cost the department about $30.00. . The wooden frame upon which it rests, and the cover cost, together, about $4.00.

In Fig. 2 Plate I, the light colored spot on each wing of the first codling moth figured is due to a break in the wing.

The details in the beetles [same figure] cannot be shown with the means our photographer has at his disposal.

Bulletin No. 12 from the Wyoming Experiment Station is just received,

containing remedies for "Ground Squirrels." They advise the use of Bi-sulphide of Carbon manufactured and sold by E. R. Taylor, Cleveland, Ohio, for 10 cents per lb. on board cars at Cleveland. A gallon weighs about 10 pounds and is sufficient to treat 160 to 200 holes. The usual method is practised; saturate a piece of cotton the size of an egg with the fluid, throw it down the burrow and stop the opening with earth. *Never bring this inflammable agent near a light of any kind!!*

Oregon Agricultural

Experiment Station

Bulletin No. 26. May, 1893.

DRAINAGE.

Address Delivered before the Marion County Horticultural Society, Salem, Oregon.

BY

JOHN M. BLOSS,

President of State Agricultural College, and Director of Station.

The Bulletins of this Station are sent free of cost to all residents of Oregon who request them.

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DRAINAGE.

(Address Delivered before the Marion County Horticultural Society, Salem, Oregon.)

During the past week, I was asked by your President to talk to you on the subject of drainage. It is a subject in which I am deeply interested, and one in which I feel that the people of this valley ought to be greatly interested.

I suppose, from what I have heard from those who came to this country in the early fifties that a large portion of the soil was then in the same mechanical condition as that which now may be seen, where it has neither been cultivated nor tramped by horses and cattle. The soil was then very loose, and old citizens have told me,— and I have no doubt about the truth of the statement—, that they could push a walking-cane down into the ground two or three feet without any particular effort. That, to-day you could not do. There has been a change come over the mechanical properties of the soil—a change not due to the climate—the climate is all right,—but a change that is due to your methods of treating the soil. You have plowed the soil when it was wet, sometimes the water followed you in the furrow protesting, as it were, for being disturbed. You expected the rain to continue, but it did not. Then came dry weather and the sun baked the soil. This has been repeated for years. You also pastured your lands when the ground was wet, and soft, and your horses and cattle puddled the whole surface. Thus the mechanical conditions of your soil has been changed since 1850.

I know that imagination has much to do with our ideas of the past. For instance, the hills do not look so high to me in my old home as they once did— the spring is not so far away from the old house as when I carried the water. But making due allowance for all the freaks of imagination, it is doubtless true that your crops were better, that your peach and apple trees grew more thriftily and produced better, and that your wheat and oats made a greater yield then than now.

It is, doubtless true, that, even in the fifties, the soil needed under-drainage, but in consequence of its looseness the water rapidly sank out of sight and more readily escaped into brooks and rivers. This, it can no longer readily do, because the soil has been baked and puddled until it is in many places almost impervious to water. Hence if drainage was needed in the fifties there is that much the more need for it now, and every additional year only adds to this necessity.

As I travel over this valley I see but little land that would not be great-

ly improved by under-drainage. I have seen none that did not need it. I have no doubt that there may be some such favored spot somewhere in the valley. Let me describe it. It is probably in some river bottom, the surface is from ten to twenty feet above the ordinary stage of the water; the surface soil is a sandy loam of considerable depth resting on a bed of gravel. Here the rain quickly soaks down through the loam and escapes through the gravel. If, however, there is a layer of tough clay between the loam and the gravel, the clay becomes, as it were, a bottom to the bucket and prevents the escape of the water—we call the result a marsh.

PURPOSES OF DRAINAGE.

Let us now see what the purpose of drainage is. It will be the same whether for the prune orchard or the wheat field.

All the products of the horticulturist and the agriculturist are air-plants, that is, they grow in the air—the roots as well as the tops must be in the air. Of course the roots may frequently be bathed in water but they cannot live for a great length of time in water, or under it. The main roots of the wheat, will under favorable circumstances, extend down to a depth of four or five feet; the same is true of timothy and clover. If you have any doubt about this, dig down by the side of a wheat plant two or three feet, then with a hose gently wash away the soil and you will find what I have stated to be true. The same is true of your prune and apple trees. This can only happen, however, where the conditions are favorable.

The water-table is a term used to express the level at which the water stands in the soil. During a portion of the year the water-table in this valley is almost, if not at the surface of the soil. In places it may be a few inches, and in others a foot below the surface. In many of the wheat fields which I have seen along the R. R., the land has been thrown up into narrow ridges and, in the furrows between the ridges, the water has been standing practically all winter. The water-table in that case would seem to be on a level with the bottom of the ditches between the ridges of land. If you will carefully examine such a field, you will discover that the wheat on the soil farthest above the water-table (in the middle of the land) is the most healthful, and that the nearer you approach the water-table the more weak and sickly is the plant. There is no accident about this. If you would examine the roots of these plants you would find that the main roots had been drowned by long continuance in the water and that the plants are now holding on to life simply by the lateral roots, and that those nearest the water-table had but little surface left for lateral roots. These plants show their condition by the yellow color.

That which is true of the wheat plant is equally true of the apple, plum, prune, and peach. The roots of these trees cannot live for 4, 5, or 6 months under water. To satisfy yourselves of this examine the rootlets that have pushed themselves down into the soil during the dry season, after they have been immersed for months, and you will find that these rootlets are practically dead and in many instances that the external covering readily slips from the woody part of the rootlet. Under these conditions the

plant or tree must necessarily loose its vigor and become diseased, because it has lost the power of resistance.

If you wish to determine the depth of the water-table on your lands, make an opening in the soil 18 inches square and 30 to 40 inches deep. Place the soil removed about the opening so as to prevent the surface water from entering. The depth to the surface of the water in such an opening, will be the depth of the water-table below the surface, because the water will never rise higher in such an opening than in the neighboring soil. In fact, the water will always be a little higher in the adjacent soil than in this opening. If the land be sandy loam it will be but slightly higher, but in fine clayey soils it may be much higher on account of greater capillary attraction. In properly drained lands, the water ought not to stand in such an opening.

Where there is no drainage, and when for a long period the water-table lies within a foot of the surface, the roots and rootlets which during the dry season extend below the water-table, are destroyed by the next rainy season. The effect is the same as if these rootlets were cut off at the same depth by shears. Thus the efforts of one season are destroyed before the next begins. Is it surprising that the tree, after a few years of stunted existence, should finally give up the unequal contest and die?

The purpose of under-drainage is to permanently lower the water-table to the depth of the tile. If the tiles are placed 40 inches below the surface then the water-table will be 40 inches below the surface provided the soil is not impervious to water, and the carrying away of the water from the surface, which acts like a roof on your house, will even extend the depth of the water-table so that it will be more than 40 inches.

Let us suppose that the proper amount of tile has been placed in the lands, and that these tile are properly laid, what must now take place in order that they thoroughly drain the ground? First the soil when examined under a microscope, will be found to be made up of separate particles with an interstice between them. These interstices, in properly drained soil, ought to be filled with air, but in undrained soil they are filled with water. These interstices form, as it were, a series of tubes. In that part of the soil immediately over the tiles, referred to above, the water sinks rapidly by gravity to the tile below and is carried away, but as the interstices referred to above are all connected, the water on either side of the drained portion would be forced into this portion by gravity. This would account for the drainage immediately over and near the tile.

I said that the water-table would in time be almost on a level with the tile. Let us see for a moment how this is accomplished. If the tile be only partly full of water then the water on either side of the tile would find itself unsupported on that side and would find its way into the tile. In this way we should soon observe that little channels were being cut back from the tile on the plane of the water-table. At first, these channels would be very short, only a few inches in length but by constant use these little channels containing little streamlets, increase in size and gradually extend farther and farther back from the tile.

This affords me an opportunity to express some words of caution. Don't expect too much from your tile the first year. The water *must get*

into the habit, as it were, of going into the tile and thus escaping. There must be time given for these little channels to extend laterally away *from* the tile. The first year they may not extend more than five or six feet on either side of the tile and hence only that much—a strip ten or twelve feet wide—will be drained. The next year these channels will be lengthened and so the next, so that at the end of the seventh year your tile ought to work better and drain the ground more perfectly than the first year. You will be surprised at the amount of very fine sand that escapes from the outlet of your tile drains. This sand comes from the extension of the little channels which have been cut back from the tile on the water-table. This, all takes time as was said before; hence you must be patient while the water and gravity are helping you to finish the work of drainage.

It is frequently asked how does the water get into the tile. Well it rises up on the underside, between the ends of the tile. It could only go down through the top of the tile while the whole tile is covered with water. The water all goes into the tiles at the ends of the sections. It does not soak through the body of the tile. Avoid the agent who wants to sell you porous tile. You don't want that kind of tile, the harder it is burned the better.

Suppose now that you have tiled your lands and removed the permanent water-table 40 inches below the surface, and suppose that by so doing you have lowered this water-table 30 inches; then, you have practically opened up to use 30 inches of soil that before was unused, because until the air could circulate freely through the soil no chemical changes could be made and no food for plants could have been prepared in it. Hence when you drain you prune orchards you incease the possibilities for their growth, and the old orchard which has practically used up all the valuable material near the surface now gets a new lease on life in this new soil.

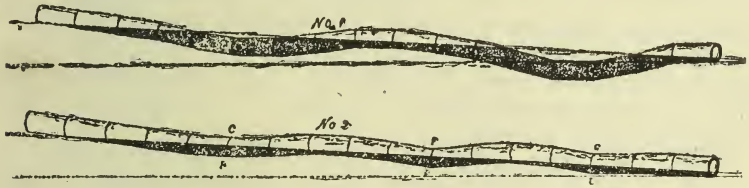
The changed mechanical condition of this permanently drained soil soon begins to show itself. The first year as you plow across the lines of the tile drains, you can readily tell where the drains are located by the lightening of the draft on the team and the friability of the soil. This condition is really more marked in the tough clayey lands than in black loams. The texture of the clayey particles is finer and the interstices smaller than in the sandy loam. The clayey soil holds more water than the loam, because the interstices although smaller, are far more numerous. This, however, only makes the necessity for drainage that much the more important. In the clayey lands the tiles must be closer together than in the loams for reasons indicated above.

It is frequently asked how close must the tile be placed. That question I cannot answer. There is no rule that can be followed. In clayey ground the tile must be closer, say from 16 to 20 feet, while in certain loams equally good drainage may be secured at 40 to 50 feet apart.

The next question which may arise is the size of the tile to be used. This depends first on the method used in laying the tile, and second on the fall or grade.

First, if the tile is laid by guess or by a water level, or rather by observing the flow of the water in the ditch, then you would better use a 6 in.

tile where a 3 in. tile would be abundant on a perfect grade, because the grade line will have many inequalities in it; and you must make an allowance for the parts below grade to be filled up with silt. If these inequalities, *up and down*, be less than six inches then some water will continue to flow from a six inch tile, as in figure No. 2 below.



Figures Nos. 1 and 2 represent tile laid on an imperfect grade. The dark portion represents the silt which has collected in points below the grade line. The light, that part not filled.
In No. 1, the tile is choked with silt at A and is useless.
In No. 2. the tile is partly filled at C, F, and G and its capacity has been limited to that of the narrowest point as at F.

The probabilities are that the inequalities will be more than 3 inches and that tile so laid, will in a few years be entirely filled with silt, and cease to be of any use as shown in figure No. I. above. However great the care taken in laying tile, there are liable to be slight inequalities. These should however be reduced to the minimun. Where there are not more than 2 in. fall in 100 ft., and where we have nothing better than the eye to determine it, it is very easy to go from two to three inches below the true grade line without discovering it. This would cause a three inch tile to be strangulated and hence useless. If tile are properly laid on a grade of one inch to the 100 ft. it will be sufficient, in most soils. Such a grade is over four feet to the mile, which is greater than the fall in many of our rivers. For this reason I would never recommend tile to be laid by a water level. If a man were to offer to furnish the tile and lay them for nothing, and I had no immediate use for the land, I think that I would let him put them in, but I certainly could not afford to pay for it.

I would have the tile put in on as perfect a grade as possible, first because it would cost but little more to do the work, possibly not so much, and second the tile that I would then need to use would not be more than half the size otherwise needed. The cost of the tile depends on the size. Thus, 3 in. about 18 cents per rod; 4 in. 25 cents per rod; 5 in 35 cents per rod; 6 in. 50 cents per rod; 7 in. 70 cents per rod; 8 in. 90 cents per rod; 10 in. $1.20 per rod. Now if a three-inch tile properly laid could be used where a 6 inch tile must be used, under the other methods, then it would be much the cheaper to lay the tile on a perfect grade.

To estimate the size of the tile, the amonnt of water to be carried away in any one day must be known. A 10 in. tile on a grade of 3 inches to the hundred feet will carry, in 24 hours, water to the depth of one inch over an area of 60 acres. The amount of water on the surface of one acre when one inch deep weighs about 112 tons. Hence a 10 in. tile would carry, at that grade, about 6,720 tons in 24 hours. A 3 in. tile would carry on the

same grade an equal amount of water from 3 acres or 336 tons. But we can rarely ever get a 3 in. tile long enough at a grade of 3 in. to 100 feet to keep itself filled with water for 24 hours. The water can't get to it fast enough. By an experiment which I made, I found that a 3 inch tile at a grade of 2 in. in one hundred feet had to be extended to a length of 700 feet before it would run full of water, when the soil was saturated. At a gtade of 3 in to the one hundred feet it is probable, that the tile could be extended to 1200 feet. If the 3 in. tile runs just full of water then it carries all the water that would be carried by a 6 in. tile in the same place, because it carries all the water that can reach a tile at that point. Hence a larger tile would be useless.

When the soil has been properly tiled to the depth of 40 inches then the water-table. as has been said, has been lowered to almost that depth. The interstices between the particles of the soil are now filled with air, and when the rain comes it readily passes down into the ground forces the air out and saturates the soil. If one inch of water were to fall in 24 hours it would saturate the soil to the depth of about 30 in., and unless the rain fell very suddenly it would all be absorbed. The rain water contains a large amount of carbonic acid gas, a very necessary plant food, which is left in the soil, while the water escapes through the little channels on the water-table to the tile drains. Within the next 24 hours this water is carried away and leaves the soil ready for the next water-bath. In the meantime the air has followed up the water as it passed toward the water-table, carrying with it its heat, imparting it to the soil, and helping, at the same time to work those chemical changes which stimulate growth.

In addition to the changes in the mechanical condition of the soil, thorough drainage does another important thing, it raises the temperature of the soil during the rainy season—winter and spring—and makes the soil more moist during the dry season. These are conditions certainly greatly desired by every farmer.

In undrained lands, there are but three ways for the water to escape: first, to pass through the soil and subsoil; secondly, to flow away over the surface of the soil; and thirdly, to evaporate and escape by means of the air. Only a very small portion of the rain which falls in this valley can escape through the soil and subsoil. Hence the greater part must escape either by over-flow or evaporation.

When your head aches, you bathe your fore-head with ether—this quickly evaporates and carries away from your temples the excess of heat. Let it evaporate from your hand and you feel that your hand is colder. The evaporation of the water from the surface of the soil has the same effect on the soil and the plants—it lowers the temperature of the soil and chills the plants. The rapidity of growth of any plant depends upon moisture and warmth.

Properly drained land is therefore warmer than the undrained: first, because the amount of evaporation is lessened; and second, that which is just as important the air circulates through the soil down to the water-table and gives up to the soil its extra heat.

During the dry season the air circulates freely through well drained

lands, because it is friable; and as the soil is colder than the air it causes a condensation of the moisture in these currents of air which makes the soil moist. All know that the more thoroughly pulverized the soil, the better it withstands drought. By proper drainage 15 days may easily be gained in the spring, and the fall may be extended an equal time. Thus a month may be gained for maturing various crops.

Some one usually asks during these talks on drainage what about the roads? Well, if you will drain your farm and make an Eden of it, you will then have something to make roads for, and with. If you will tile drain your roads to the depth of 40 inches—placing a tile on each side of the road-way—raising the center of the road so that the water will run off, you will have ordinarily good roads, and especially is this true if you drain the lands on either side of the road. No energetic community need to have bad roads in this country, nor does a town or city need to have muddy streets—don't wait for sewerage, that will come later, but tile-drain your streets and grounds.

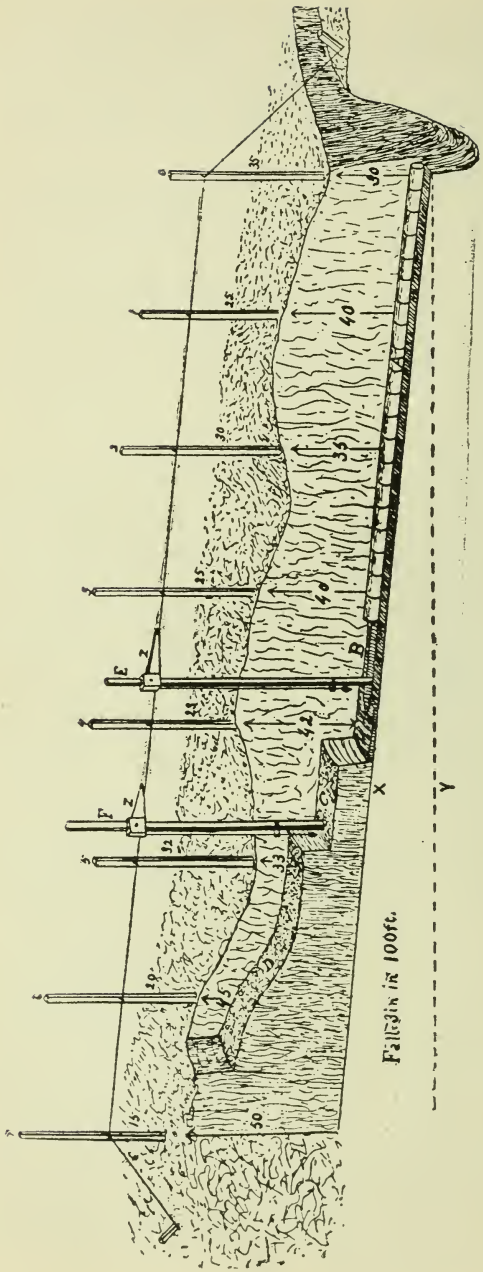
METHODS OF LAYING TILE.

In order to properly under-drain your farm there should first be a carefully prepared plan; it would be better to make out a complete map, drawn to some scale, say one inch to the hundred feet. The first thing to be secured is a proper outlet, second the position of the mains which are to carry the water away. The size of these must be adapted to the amount of water to be carried; and third the lateral drains. I would suggest that you stake out these mains and laterals just as you wish the drainage to be when fully completed. Drive a good stake 18 in. long down into the ground until the top is even with the surface of the soil; this is the grade stake. By the side of it drive in a stake two feet in length and leave one foot exposed; this is the station stake. These stakes should not be more than 25 ft. apart. When this has been done get an engineer, if you are not one, and have a complete survey made of your lands.

If your plan shows that the laterals are to be 20 ft. apart and you are not able to do all the work in one season; then put in the mains and put in lateral drains 80 ft. apart, the next year make the laterals 40 ft. apart, and the next year put in twice as much tile and make them 20 ft. apart. The same grade stakes will remain through that period.

The engineer will give you the depth of the tile at each stake or station and, if competent, can tell you the size of the tile to be used. This will cost something, but when you have once prepared for the work it will take him but a short time to level and make the calculation for a thousand rods of tile. If this is properly done it will save many times its cost. We speak of houses and barns as being permanent improvements, but really the tile drainage will be the only permament improvements that you will ever put on your lands. A thousand years hence, if it has been well done it will still be new. Hence it should be well done.

The following device, illustrated in the cut below, is the best means that I have found for securing a perfect grade in laying tile, without an engineer to test the work as it is completed.



Here it will be observed that there are 8 stations. The survey shows the depths at each grade-stake as follows:

Stations o.....30 in.
" 1.....40 ,,
" 2..... .....35 ,,
" 3.....40 "
" 4.....42 "
" 5.....33 "
" 6.....45 "
" 7.....50 "

At the side of the grade-stakes, stakes about four feet in length are driven into the ground which have the station marked above them. On the side of these stakes is a hook. The first stake at *o* is driven into the ground until the hook is just 35 inches above the grade-stake. This makes the bottom of the tile just 65 inches below the hook. The second is driven into the ground until the hook is just 25 inches above the grade-stake making the bottom of the tile just 65 inches below the hook. The other stakes, it will be observed, have each been driven into the ground until the hook is just 65 inches above the bottom of the tile.

Then a wire (a fine steel wire of the kind used for holding stove-pipes in place) is stretched very taught on the ground between the two inclined stakes, and when fastened, it is then lifted into the hooks on the stakes.

This wire must be, if the survey is correct, a straight line and parallel with the bottom of the ditch,and just 65 inches above it. This wire is on one side of the ditch but not over it.

In the preceding illustration the line Y is a level or horizontal line, the line X is the grade line, and the space between these lines indicates the fall.

The difficulty in constructing a ditch for a tile drain, on a grade, may be seen in the cut on the preceding page. The upright stakes are 25 ft. apart, but it will be observed, that a different depth is required at each point. The tendency is to make the ditch at all points about the same depth below the surface. In that case the bottom of the ditch would be parallel with the surface Thus in the illustration the first cut, the depth of one spade, about 15 inches, will have a bottom parallel with the surface of the soil, as seen at D. The second may be made in the same way, provided it does not reach the grade of the tile. In the illustration the bottom of the second cut, at C is placed on a grade parallel with the line X by means of the measure at F. The third cut is made in the same way but is made so that it lacks about 1½ inches of being to the grade at which the tile is laid, as indicated in the figure. Then with the bottoming tool, or spoon, the bed for the tile is cut out carefully until the grade line is reached. This will be determined by the measure indicated at E. These measures are constructed as follows: the upright piece is 6 ft. long and 2½×⅝ in. This is laid off in inches. Attached to the upright is a movable arm Z about 18 in. in length having a thumb-screw for fastening it at any point on the upright. This arm is fastened at right angles. A plumb is attached to one end of the movable arm. The movable arm in this case is fastened just 65 in. from the bottom of the upright. Hence when the measure is placed vertically on the bottom, if the grade line has been reached, the arm ought to touch the wire. In this way the bottom on which the tile rests may be made a perfect grade and parallel with the wire.

It is important that the tile be placed in soil which has not been disturbed, that the alignment may not be affected by the tile settling. The tile should be laid so that the ends are brought as close together as possible, and so that the tube will be continuous.

By the method above indicated short lines of tile may be laid on a perfect grade without any survey being made, by first determining the depth of the ditch at each end and then adjusting the wire an equal distance above each end and in a straight line between these points. The height of the wire above the surface of the soil is immaterial, but it must be placed parallel with the grade on which the tile is to rest.

Those who are interested in the subject of drainage will find much of interest in works devoted to that subject by such authors as French, Manly Miles, Klipart, and Warring.



A. E. S.
March 26, 1894

Oregon Agricultural Experiment Station

Bulletin No. 27. December, 1893.

BOTANICAL DEPARTMENT.

Plant Diseases: Their Cause and Prevention.

MOSES CRAIG, Botanist.

The Bulletins of this Station are sent free to all residents of Oregon who request them.

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Plant Diseases:

THEIR CAUSE AND PREVENTION.

Though there is much literature on this subject, it is scattered through so many botanical books, magazines and experiment station bulletins as to be inaccessible to most Oregon farmers, who lack the time and means, as well as the books, necessary for the study of vegetable pathology. A desire on their part for more information is shown by the many letters of inquiry received by this department during the past year.

PURPOSE OF THE BULLETIN.

The object of this bulletin is to present to Oregon farmers, in a condensed and popular form, what is now known about the most important diseases attacking cultivated plants. Fortunately many morbid conditions destructive in other states have as yet caused little damage here, but new diseases are gradually coming in and agriculturists should be able to recognize them and apply proper remedies in time to prevent their gaining a foot-hold in the state.*

The methods of treatment here given are those that have been found most beneficial in other states but whether they will prove so here and what modifications are necessary can only be determined by a careful series of experiments which, contrary to what many persons suppose, will require several years for their completion.

*Our purpose may be misunderstood by some who think that only the direct results of technical experimentation should be included in experiment station bulletins. To such the writer would say that while he partially agrees with them he thinks some general information on this subject is now needed in the state and hopes that the bulletin will prove serviceable as an introduction to investigations the results of which will be published, from time to time by this department.

ENEMIES TO AGRICULTURE.

A successful agriculturist must not only know the conditions affecting plant growth but be able to recognize the enemies of his crops and protect the plants from them. Weeds, insects, and fungous diseases are his worst enemies,† and some knowledge of their nature and habits is necessary to successfully combat them. It is evident that the more thorough his knowledge of plant diseases the more effective will be the means employed to destroy them.

Three questions regarding these diseases are of great importance to the husbandman, namely: What causes them? How, and to what extent, do they injure plants? How shall he best prevent this injury?.

CAUSES OF DISEASE.

Plants live and are healthy only while repair and waste are properly balanced. When loss becomes greater than gain the plant dies from old age (maturity), from failure of food supply (starvation and suffocation), or from morbid conditions caused by an injury (disease).

Plant diseases are produced in various ways: by fungi; by insect injury; by something in the environment of the plant, or by a combination of these causes, so it is often difficult to determine their exact cause. Insects frequently weaken plants by wounding the leaves or bark, then fungi attack them and complete the injury already begun. Sometimes necessary food elements are absent. So to secure the best results the Entomologist, Horticulturist and Chemist must work hand-in-hand with the Botanist in devising remedies.

ETIOLATION.

Some diseases are due to weakness or imperfect nutrition of the plants caused by improper or insufficient nourishment which destroys their verdure making them pale and sickly.‡

This blanching, or etiolation as it is called, usually comes from overshadowing the plants, if this is the cause when again exposed to sunlight they will recover their normal color. Celery and plants grown in dark rooms or under the shade of trees are familiar examples. This disease which is often aggravated by cold, uncongenial weather and bad drainage predisposes the plant to fungus attacks.§

Paleness may also result from poverty of the soil, from excessive moisture and from the depredations of insects in the roots or stem, consuming the plant food in the sap. This starves the leaf-cells rendering them unsusceptible to the action of light.‖ If the debilitating cause is not removed the blanched leaves soon wither and droop or shrivel up and drop off according to the extent of injury.

Chlorosis is a pallid condition of plants exposed to direct sunlight. The best remedy is watering them with a weak solution of green vitriol.

DEFOLIATION.

When growing leaves are injured by insects or noxious vapors, growth of the margins being arrested, they become curled and crumpled.

† F. L. Scribner, Weeds of the Farm, Bul. Tenn. Ex. Sta., Oct. 1888, Vol. 1 No. 3 p 29
‡ M. T. Masters, Plant life on the Farm, 1884, pp. 114-15.
§ B. D. Halsted, N. J. Experiment Station, Rep. 1892, pp. 298 and 303.
‖ Wm. Rhind. Vegetable Kingdom, 1855,p. 132.



FIG. 1—Healthy Pear tree.



FIG. 2—Tree defoliated by pear blight.

Sunburn and fungi often cause irregular brown patches of decayed tissue which may spread and gradually involve the whole leaf.

If from these or other causes a tree loses its foliage in early summer its growth will be stunted ¶ as owing to impaired nutrition a thin layer of wood is formed that season and probably the next also. Vigorous plants may produce a second crop of leaves later in the season but this will be at the expense of next year's buds, as nutritive material in the crude sap sent up by the roots must be elaborated and returned for the use of the plant.

EFFECTS OF FROST.

Other causes of plant debility are too rapid growth and sudden changes of temperature.

High temperatures usually cause wilting, water being given off from the leaves more rapidly than it is absorbed by the roots.* This may be prevented by shading or watering the plants before the cells lose their necessary fullness and the sap ceases to flow readily. Low temperatures disturb the leaf functions and chlorophyll being imperfectly formed, give the plant a yellow tinge as in frosted wheat. Occasionally the sap freezes in

¶ H. M. Ward, Timber and its diseases, 1889, p. 244.
* G. L. Goodale, Physiological Botany, 1885, p. 277,

the cells rupturing their walls and causing death, the leaves then become limp and blackened. When plants are frosted the fluid contents of the cells escape and freeze in the intercellular spaces† arresting all vital functions. If gradually thawed, the water may be re-absorbed and life action resumed.‡

SUN SCALD.

Light spring frosts and chilling winds often damage green, immature wood of fall growth or young growing shoots and buds so slightly as to be unnoticed at the time but still cause a withered or blighted appearrance, called sunscald, later in the season. The bark begins to crack and peel off, the inner bark dies and the branches, sometimes the whole tree, die. Sometimes the bark rots off near the ground where it was surrounded by snow during the winter, thus killing the tree the second season. This may be prevented by wrapping the trunk or branches with coarse cloth.

The best remedy is to have the wood fully matured before winter sets in. Avoid the application of rich manures late in the season,⅔ and root-prune by plowing around the trees about the middle or last of August to check a late growth of branches.

DECAY AND DEATH.

Death may be sudden and complete as in trees broken by the wind or struck by lightning; or it may be partial and gradual when caused by fungous attacks, dust, exposure to noxious vapors, or loss of leaves. Decay may begin in the roots, in the stem, in the intermediate collar, or in the leaf-cells.

Death of the roots from decay, exposure to the air, drouth, or ravages of insects larvae, mice, gophers, etc. produces effects similar to those given under etiolation. Injuries to the leaves and stem are given under the effects of frost, sun-scald, and parasitic fungi.

When small branches are bent or partially broken the parts will reunite on being properly secured in their natural positions, provided the limbs are not crushed.‖

KEEP YOUR PLANTS HEALTHY.

Remember always that plants do not succumb to disease until they have in some way become weakened, so when they present a sickly appearance seek for the causes of weakness, remove them, if possible, and then apply preventive or curative treatment according to the nature of the case. Prevention is the best and cheapest remedy.

Pay attention to the general health of your plants, see that they are not overcrowded, that they have a suitable soil, neither too wet nor too dry, and one containing the food elements necessary for their best developement. See also that their vitality is not sapped by the ravages of insects and fungi which always cause the most injury to the weakest plants.

AVOID INSECT INJURY.

There are a large number of diseases caused wholly or in part by insects but as the Entomologist exercises perpetual jurisdiction over them, few are mentioned here. Those desiring further information are referred to him and to bulletins number 3, 5, 10, 14, 18, and 25 of this Station.

† Otto Lugger, Minn. Ex. Station, Jan. 1889, Bul. No. 5, pp. 46-51.
‡ M. T. Masters, Plant life on the Farm, 1884, pp. 64-5.
⅔ S. T. Maynard, Hatch Ex. Station, Mass., Bul. No. 8, Apr. 1890, p. 7-8.
‖ Wm. Rhind, Vegetable Kingdom, 1855, p. 35.



FIG. 3 Lower surface of grape leaf attacked by Erinose.

The serious injuries caused by scale-insects or bark-lice (*Coccidæ*.)** are frequently mistaken for fungous diseases which they occasionally resemble, but careful scrutiny under a hand-lens will usually dispel all doubt.

ERINOSE.

The name erinose is now used to designate a leaf disease caused by a minute spider (*acarid*) but formerly thought to be a fungus. The appearance of the affected grape leaves is similar to that caused by the downy mildew from which it may be readily distinguished under a microscope. Thus examined the spots are seen to be composed of shining hair-like growths with enlarged tips quite unlike the branched fungus.

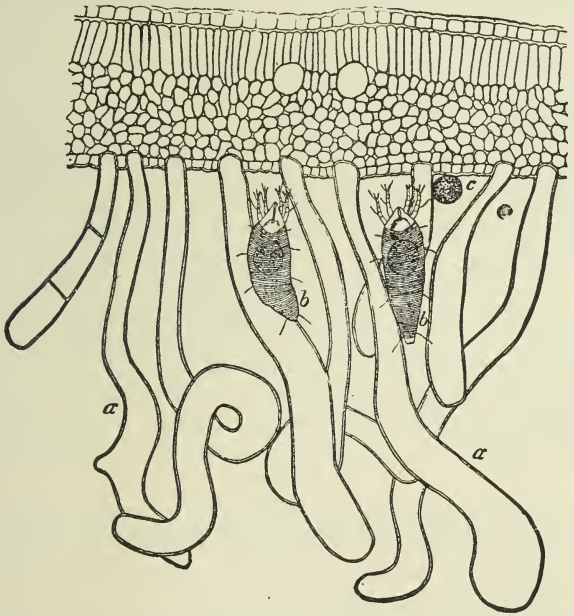


FIG. 4. Cross section of leaf through one of the galls showing the hairs *a* formed from elongated epidermal cells, two of the animals *b b* and one of the eggs *c*.

** J. H. Comstock, Introduction to Entomology, 1888, pp. 134-5.

Erinose usually appears in early summer as small, white, raised spots scattered over the lower surface of the leaves, these soon enlarge and become a dark reddish-brown color. Leaves attacked when young do not attain normal size and if badly infested become curled with the convex side uppermost. This disease rarely makes much difference in the crop and when necessary the multiplication of the insect may be checked by repeated applications of sulphur to the young shoots.†

MOSS COVERED TREES.

Mosses and lichens though not parasitic often cover trees impeding the circulation of air and hastening decay by retaining water about the branches. When enveloping young shoots they intercept light and interfere with the development of wood and the production of foliage.‡ In early spring, before the buds open, spray the trees with lye which will not only kill the lichens growing on the trees but also destroy the many fungus spores lodging on them and on the branches.

PARASITIC FUNGI.

As most plant diseases are due directly or indirectly to attacks of fungi, is is necessary to know something about them. They are minute flowerless plants destitute of the green coloring matter called chlorophyl and thus unable to assimilate food for themselves. There are two kinds, saprophytes those that live on dead organic matter, and parasites those that draw nourishment from living plants called their hosts.‖ The common mushroom is a saprophyte while corn smut and apple scab are parasites.

Scientists formerly thought that the vegetable parasite was a diseased condition of the host itself, for example, that the rust of wheat was only the degenerated cell tissue of the wheat plant. Though much study is still needed to disclose the best methods of preventing the growth and development of fungi, botanists now know that they are the descendants of preexisting forms; that they begin their growth outside of the host-plant and gain entrance by penetrating the membranes or through the stomates.¶

Their mycelia ("vegetative system")usually grow within the body of their host but some like the "Surface Mildews"* grow on the outside sending small fibers called haustoria into the tissues of their host through which they pass, abstracting food much like roots through the soil.†† In naming fungi the fruit (consisting of spores which are analogous to seeds) is made the basis of classification as the reproductive system is more diversified than the vegetative one ‡‡ and the differences are more readily described.

USE OF FUNGI.

The only use of fungi seems to be in checking the growth of noxious plants by closing their stomates ("breathing pores") thus choking them to

† F. L. Scribner in U. S. Dept. of Agr. Rep. 1887. pp. 361-63.
‡ J. D. Hooker, Descriptive and Analytical Botany, 1872, p. 948.
⁂ Wm. B. Alwood, Va. Ex. Station, June 1892, Bul No. 17, p. 64.
‖ Bennett and Murray, Cryptogamic Botany, 1888. pp. 316-17.
¶ T. J. Burrill, Par. Fungi of Ill. St. Lab. of Nat. His. Art. III, part I, 1888, pp. 143-4.
* Periosporiaceæ.
†† T. J. Burrill, l. c. Art. VI part II, 1888, pp. 387-88.
‡‡ F. L. Scribner, in U. S. Dept. of Agr. Rep. 1885, pp. 76-7.

death as in the black-rust on Pin-weed and Skunk-weed.[‡] They thus do much toward destroying the many weeds found in the gardens and orchards of the state. If they confined themselves to weeds alone all would be well but they seem to prefer the more delicate, richly fed and juicy cultivated plants which they eagerly attack. So we cannot depend on these parasites as weed-killers.[‖] The poor host becomes weakened and appears taller, slenderer and paler than the healthy plants. The result of a fungus attack is either total destruction of the plant or an abnormal development and distortion of the affected parts as in the plum-wart, plum-pockets, or the club-foot of cabbage.

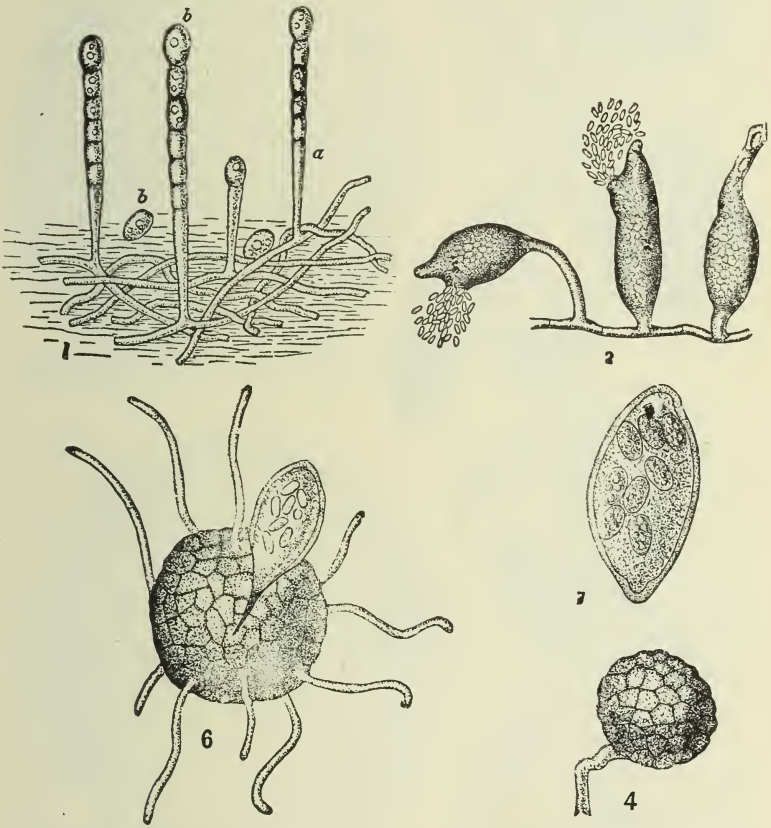


FIG. 5 Powdery mildew of gooseberry. 1. Mycelium with conidiophores *a* and conidia *b* in rows, as found on the leaf surface. 2. Pycnidia discharging spores. 4. A young perithecium. 6. Ripe perithecium with appendages. It has been broken open and the spore sac (ascus) is escaping. 7. A spore sac showing the eight spores. U. S. Dept. of Agr. Rep. 1887, P. 395.

‡ *Puccinia Giliae*, Hark? on *Gilia intertexta*, Steud and G. *squarrosa*, H. & A. These are new hosts, so far as I am able to ascertain with the limited literature at my command. The fungus proved very destructive to these weeds during the summers of 1892-3 causing large patches of them to turn yellow and die long before the summer was over.

‖ B. D. Halstead, N. J. Ex. Sta. Rep. 1892, pp. 342-5.



Figure 6. Plum pockets. Branch natural size.

Of the many examples of damage done by fungi, two must suffice.

Prof. Harwood says:¶ "A low estimate of the loss in Michigan this year from Oat Smut is over one million dollars. Dr Sturtevant gives * the annual loss in central New York as 9½ per cent. which he considers a fair average for the eastern United States.

Dr. Burrill estimates† the damage annually caused in Illinois by Wheat Rust at more than 500,000 bushels valued at $375,000. Prof. H. L. Bolley says: ‡ "In Indiana it amounts to from $300,000 to $500,000 annually and for the United States at least one per cent. or more than $4,102,000."

PREVENTION OF FUNGUS ATTACKS.

Though the damage caused by plant diseases in the United States amounts annually to several millions of dollars, §§ people see their crops injured or destroyed without attempting to prevent the injury, thinking it inevitable, when, by a little effort and at slight cost, most of these diseases could be prevented and the harvest correspondingly increased. For example: Prof. Swingle says: ‖‖ "The net gain from universal seed-treatment of oats in the United States during the decade ending 1890 would have been more

¶ Mich. Ex. Sta. Bul. No. 87. Sept. 1883, pp. 3 and 8.
* Bul. Bot. Dept. Iowa Agri. Col., Nov. 1884, P. 125, quoting from a bulletin of the N. Y. Ex. Sta.
† T. J. Burrill, l. c. Art III part I P. 145.
‡ Perdue Ex. Sta. Bul. No. 26, July 1889, p. 8-9.
§§ F. L. Scribner in U. S. Dept. of Agr. Rep., 1885, p. 76.
‖‖ W. T. Swingle, in Farmer's Bul. No. 5, U. S. Dept. of Agr.

than $1,624,570. And Prof. Kellerman tells us† that "The yield of oats when treated with hot water is increased, not simply by an amount which equals the portion destroyed by smut, but by at least twice that amount" which would make a saving of $3,250,000 in this disease alone. A fair idea of the enormous annual loss can only be gained by adding up the damage occasioned by all the rusts, smuts, blights, mildews, moulds, etc. so prevalent in many places.



FIG. 7. Green and healthy Peach.

Since these fungi develop mostly within the tissues of their hosts, there is little possibility of saving a plant once really infected, for what would kill the parasite would probably kill or seriously injure the host also. Our chief object then is always preventive, that is to protect the plant by a thorough application to its exposed surface of some preparation which shall, without injuring the plant, kill or prevent the germination of fungus spores that may alight upon it.‡

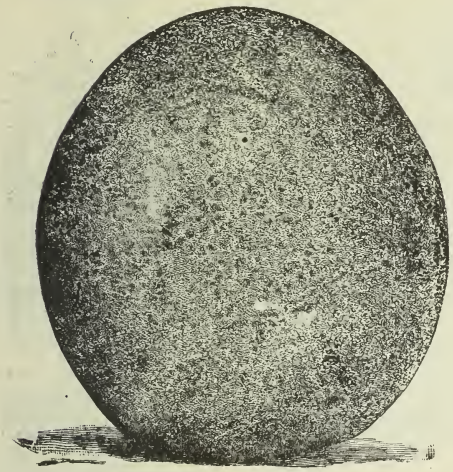


FIG. 8. Red-spotted and prematurely ripe. U. S. Dept. of Agr Rep 1888, P. 404.

SPRAYING MIXTURES.

A number of such preperations have been tested with good results and some of the more important formulas are given below. The basis of most fungicides is a solution of copper sulphate which is an ideal remedy being both cheap and effective. Oregon foliage is more readily injured than that of eastern states, & so care should be taken not to have the solutions so strong as to burn the foliage. The strength of all mixtures should be suited to the severity of the disease, the condition of the plants and the locality.

1. *Bordeaux mixture*:* Sulphate of copper 6 pounds, quick lime 6

† Kansas Ex. Station, Bul. No. 22, Aug. 1891, p. 81.
‡ B. D. Halstead, Rep. N. J. Ex. Station, 1891. p. 239.
& E. R. Lake, Bul. No. 3, Or. Ex. Sta., Oct. 1889, pp. 3-4.
* Rep. Oregon State Board of Horticulture, 1893, p. 91.

pounds, water 22 gallons. Dissolve the powdered blue-stone in hot water, slake the lime in another pail, mix the solutions thoroughly, when cool, straining them through a coarse cloth and dilute to 22 gallons. Try a more dilute solution using fifty gallons of water, this cheaper and more easily applied mixture will probably prove as effective for many diseases.

2. *Modified eau celeste:* Sulphate of copper 1 pound, Sodium carbonate 2 pounds, strong aqua-ammonia 1½ pints, water 30 gallons. Dissolve the blue vitriol and washing soda separately in water and when cool carefully add the ammonia. Then dilute for use.‡‡

3. *Ammoniacal copper carbonate:* Into a large dish pour one quart of strong ammonia and three ounces of copper carbonate and stir rapidly. The clear liquid thus formed may be kept bottled till needed when it should be diluted to 22 gallons. ⁂

4. *Liver of sulphur:* Dissolve seven ounces of potassium sulphide in 22 gallons of water. A stronger solution used for soaking seed oats is made by dissolving one pound of the sulphide in 24 gallons of water.

5. *Iron sulphate solution:* Dissolve 5 pounds of green vitriol (copperas) in 22 gallons of water and use immediately. ‖

6 *Lye for spraying trees* Concentrated lye 4 cans, water 22 gallons.

7. *Disinfecting solution for pruning knives:* Take crude carbolic acid one pint; strong white oil soap one gallon. Mix with two gallons of boiling water, let the mixture stand for 24 hours and then add 7 gallons of soft water. †

. *Combined fungicide and insecticide:* ‡ Add two ounces of Paris green or London purple to each 25 gallons of Bordeaux mixture. London purple must be used instead of Paris green in all fungicides containing ammonia. Mix 2 ounces of London purple with two ounces of lime and add to each 25 gallons of eau celeste.

9. *Corrosive sublimate solution:* Dissolve 4½ ounces of bichloride of mercury in 30 gallons of water. ¶

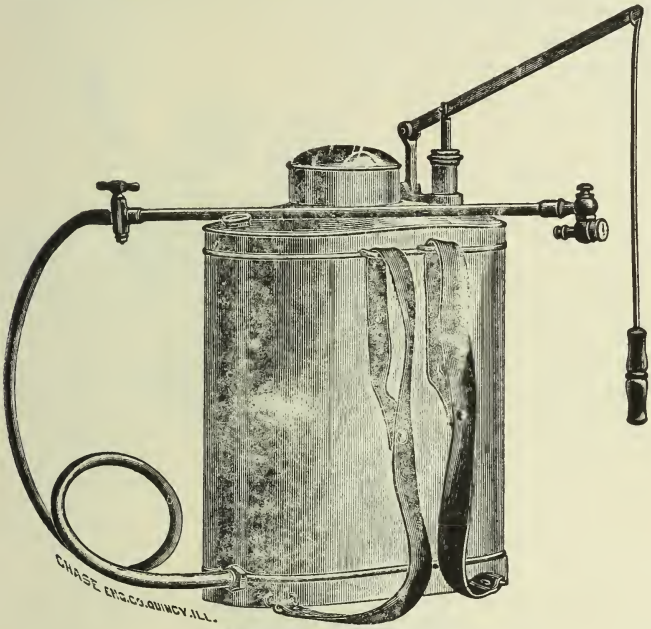


Fig. 8. SPRAYING AN ORCHARD.

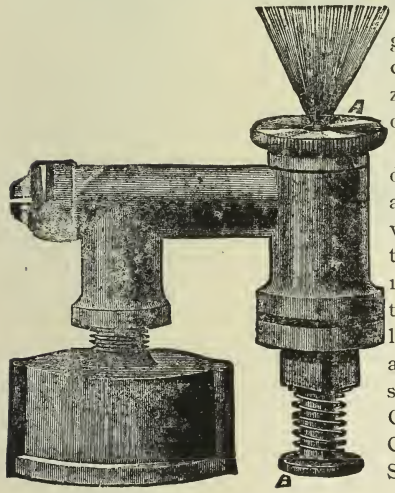
‡‡ F. L. Scribner, Tenn. Ex. Sta. Bull. C., May 10, 1890, p. 6.
⁂ F. L. Scribner, Sec. of Vegt. Path. U. S. Dept. of Agr. Cir. No. 5. p. 7.
‖ G. McCarthy, N. Car. Ex. Sta. Bul. No. 76, March, 1891, p. 5.
† W. B. Alwood, Va. Ex. Sta. Bul. No. 17, June 1892 p. 69.
‡ J. J. Black, Cultivation of the Peach and Pear, 1886, p. 283.
‡ B. D. Halsted, N. J. Ex. Sta. Rep. 1892, p. 341.
⁂ H. L. Bolley, N. Dak. Ex. Sta. Bul. No. 9, March 1893, p. 32.

SPRAYING MACHINERY.

An expensive outfit is not necessary in order to protect your plants: the essentials are a double acting force-pump, a barrel or other receptacle for the mixture, and a nozzle which will throw a very fine spray for a long distance. The pump should be mounted on a barrel and placed in a cart so as to be readily moved about in the orchard and vineyard.



KNAPSACK SPRAYER.



VERMOREL NOZZLE.

In small orchards, vineyards, or gardens knapsack sprayers are often convenient and with a Vermorel nozzle which throws a fine fog-like spray do good work.

Success and economy in spraying depend largely on the nozzle used, and the ability to place the spray just where it is needed is the great object to be attained. The Nixon or Climax nozzle is said to be the best for tall trees as it throws a strong spray for a long distance, but both this and the above are effective and give good results. The Nixon Nozzle and Machine Co., Dayton O.; the field Force-pump Co., Lockport, N.Y.; Mitchel, Lewis, Staver, and Co., Portland, Or., and

many other well known firms carry large stocks of reliable pumps and nozzels. For a fuller account of spraying machinery see the bulletins of this Station.*

ECONOMY IN SPRAYING.

Does spraying pay? Yes, when the work is well and carefully done. The trees or vines should be thoroughly wet so there will be a thin layer of the fungicide over the entire plant surface. Do not waste the mixtures by



FIG. 11. Anthracnose of the grape,† 1 A bunch of grapes partially destroyed.

drenching the plants so the solution drops to the ground like rain covering the grass and poisoning stock that may be pastured in the orchard. Begin spraying early but never spray while the plants are in bloom. Spray early

* No. 3, pp. 15-24, No. 10, pp. 16-22, and No. 25, p. 8.
† U. S. Dept. of Agr. Rep. 1886, p. 137

in the morning or late in the afternoon, if the day is hot, to avoid injury to the foliage.

It has been found by experiments in Ohio orchards that, at a cost less than 15 cents a tree, both insects and fungus diseases can be held in check and the value of the crop doubled which will more than pay the expense of spraying. † At Smyrna, Del. 1200 vines were sprayed five times with Bordeaux mixture for black rot at an expense of 3 cents a vine, giving a net saving of $62.60 per acre ‡ over the unsprayed vines. In another experiment the profit from treatment was 72 cents per vine. § Dr. Halsted says: ‖

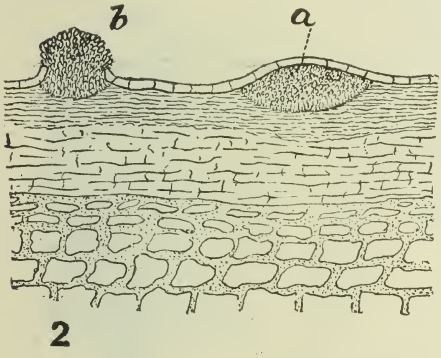


FIG. 12. 2, Enlarged vertical section of diseased berry, showing epidermis and sub-epidermal tissue. Large numbers of conidia spores are developed beneath the epidermis *a* which they rupture and escape *b*.

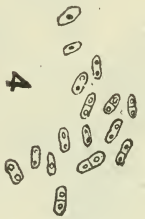


FIG. 13. 4, Mature "summer spores" (conidia.)

"In a poor season it pays to spray in order to save as much of the product as possible and in years of abundance it is likewise profitable, that the product may be increased in attractiveness and thereby catch the eye of the purchaser."¶

When a diseased plant is too far gone to be saved by spraying, prompt measures should always be taken to prevent infection the following season of healthy neighboring plants, of the same kind, by carefully cutting off and burning all affected parts which may harbor fungus spores during the winter.

NEED OF CO-OPERATION.

Thoroughness is the secret of success and epidemic plant diseases cannot be successfully combated without the earnest co-operation of all living in an infected region, since one infested field or orchard is a breeding place

† W. J. Green, Bul. O. Ex. Sta., Dec. 1891, Vol. IV, No. 9, p. 208.
‡ F. D. Chester, Del. Ex. Sta. Bul. No. 6, Oct. 1889, pp. 3 and 13.
§ Del. Ex. Sta. Bul. No. 10, Oct. 1890, p. 14
‖ N. J. Ex. Sta. Rep. 1891, p. 235.

from which the germs of disease are wafted over the neighborhood. The most perfect co-operation is that enforced by law. The New Jersey Experiment Station has power to destroy crops infested with new or dangerous fungi and the state reimburses the owners.* California and Washington have appointed inspectors of fruit-pests with power to quarantine plants and fruit packages believed to contain disease germs liable to spread contagion.† Many other states have effective laws for the suppression of fungus diseases and are rigorously enforcing them.

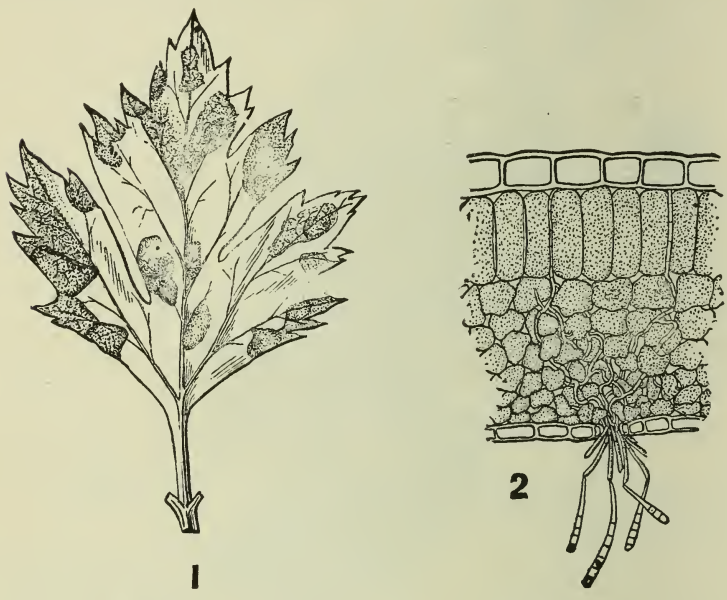


FIG. 14 Celery blight. 1, Usual appearance of a blighted leaflet. 2, A much magnified transverse section of leaflet, showing mycelium transversing the loose tissue to pass through a stomate on the lower surface and develope "summer spores" (conidia.)—U. S. Dept. of Agr. Rep. 1886. p. 137.

NEED OF LEGISLATIVE ACTION.

Why can not Oregon follow their example? Our fruit is naturally better than theirs, ‡ owing to advantages of soil and climate ⁂ and will if kept free from scab and blight continue to bring higher prices in the market. Why do we now see so many scabby apples, blighted pears, and rotting peaches? Simply because some fruit growers are as yet too ignorant or too slothful to keep their orchards free from these pests and thus furnish breeding grounds from which the germs of disease are scattered broadcast

*Rep.N J. Ex. Sta. 1889, P. 345 "An act to prevent the spread of fungus diseases of plants.
†W. E. Collins in Rep. Or. St. Bd. of Hort. 1893, Pp 7-8.
‡See list of awards at World's Fair in Chicago, 1893.
⁂E. W. Allen, Rep. Or. St. Bd. of Hort. 1893 Pp. 100-4.

through the state while their more thrifty neighbors are struggling to overcome the results of this negligence. If they are too short-sighted to avail themselves of profitable means of prevention they should not be permitted to injure the enlightened husbandman who sprays his trees.

Here is a good field for legislative action. Our present laws being



FIG. 15. Shoots on limb of a tree badly diseased by yellows. Such shoots remain entirely unbranched in healthy trees. U. S. Dept. of Agr. Rep. 1888, p. 404.

insufficient ‖ the State Board of Horticulture has drafted a new law and amended the former one. ¶ Let us have these stricter and more effective laws compelling the immediate destruction of all diseased plants and fruit so the careful cultivator will no longer have to labor alone but all will work for the common good of the state and its productions.

‖J. R. Cardwell, Rep. Or. St. Bd. of Hort. 1893, pp. 8-9.

¶ l. c pp. 10-13 "An Act to define certain powers and duties of the St. Bd. of Hort." and p. 13 "An Act to prevent the sale.....of infected fruit or trees.....or other material, and to prescribe penalties therefor."



FIG. 16. Healthy peach shoot. Reduced to 1-5 natural size.



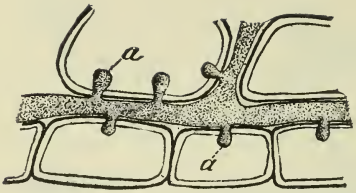
FIG. 17. Downy mildew of the grape. 1, A "summer spore" (conidium.) 3, same showing contents divided into zoospores, which are escaping in 4. 5, a highly magnified zoospore showing the cilia by which the "living spore" moves about. 8, The same, having lost its hairs, pushing out a germ tube. 10, A group of fruit bearing filaments (conidiophores), which have grown out of the leaf through one of the "breathing pores" (stomates). U. S. Dept. of Agr. Rep. 1886, p. 136.

Having studied general methods of treatment, we will now consider briefly the more important diseases which attack cultivated plants. *

FOOT-ROT OF CABBAGE.

The club-foot of cabbage, turnips and other Cruciferous plants is caused by a slime mould (*Plasmodiophora brassicae*, Wor.) which commences its rapid growth early in the life of the seedling causing the rootlets to become

* Limited space prevents many special references. Free use has been made of Experiment Station bulletins and reports of the U. S. Dept. of Agriculture, to which those desiring more detail are referred.



9



12

FIG. 18. 9. The shaded portion represents the vegetative part (mycelium) of the fungus growing between the cells of the host plant. *a*, *a*, suckers (haustoria) entering the cells. 12. A "winter spore" (oospore) with thick walls to protect it from frost.

covered with smooth, spindle-shaped swellings whose flowing outline distinguishes them from the abrupt excresences caused by insects. The older portions soon decay and new roots sent out above also become knotty and decayed giving off a very offensive odor.

Burn all diseased plants. Do not throw them on the manure pile over winter to be carefully sown in the spring, or leave them rotting in the fields to infect the soil and roots of next year's plants. Set healthy plants in a new field and keep the soil free from mustard-like weeds which frequently spread the contagion. An alternation of crops, raising other than Cruciferous plants, for two or three years will reduce the disease. Lime applied to the soil is often beneficial. The leaf-spot of Horse Radish may be prevented by spraying with Bordeaux mixture.

DISEASES OF THE GRAPE. *

Powdery mildew (*Uncinula Spiralis*, B&C) attacks the leaves, young stems and fruit. Spray with potassium sulphide soon after the leaves start in spring and again just before blooming. Downy mildew(*Peronospora viticola*, D. By.) seldom injures the fruit directly. Spray with ammoniacal copper carbonate as soon as the first leaves are fully formed and repeat every two or three weeks until the berries begin to color. It is often well to spray once or twice after the fruit is harvested to insure perfect ripening of the wood. Black rot (*Physalospora Bidwellii*, Sacc) appears as livid brown spots on the berries. The spots increase covering the entire grape which soon loses its fullness and becomes dry, hard and shriveled to one-half or one-fourth its original size. Collect and burn in autumn all fallen berries and trimmings from diseased vines. Spray vines before the buds begin to swell with a strong solution of green vitriol. Soon after the buds open spray with dilute Bordeaux mixture and again just before the flowers open. When the berries are the size of peas spray with ammoniacal copper carbonate and again two weeks before the grapes are ripe.

ANTHRACNOSE OF BEAN.

On the pods large brown spots (*Glaeosporium Lindemuthianum* Sacc.) are produced in the center of which spores, easily blown about by the wind

* F. L. Scribner, Dept. of Agr. Rep. 1886, pp. 95-116.

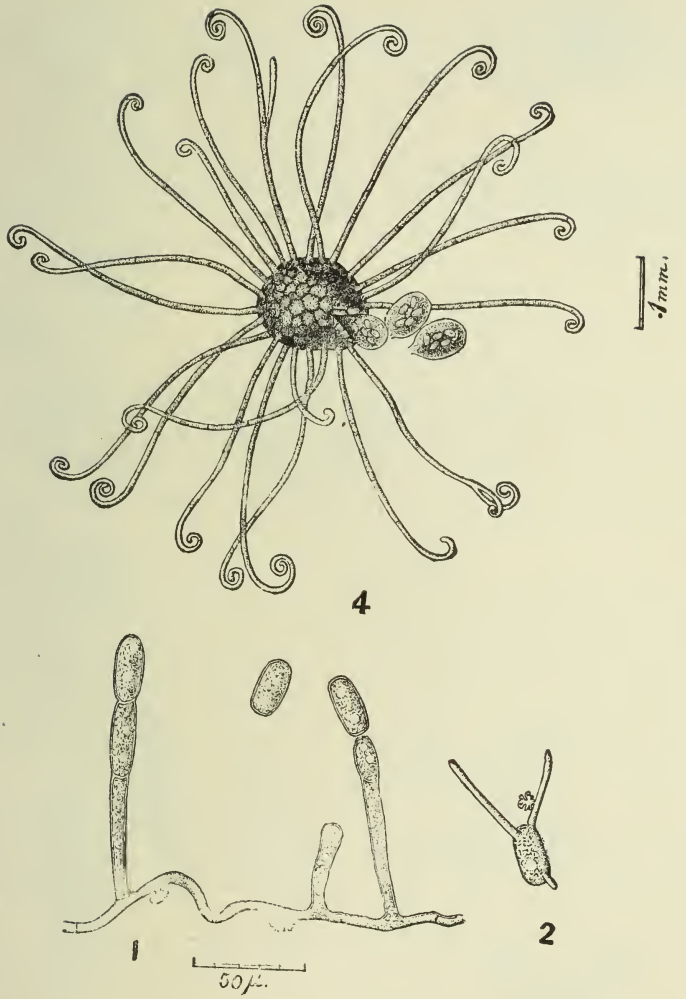


FIG. 19. Powdery mildew of the grape. 1, Mycelium from surface of leaf showing two haustoria and three upright fruit bearing filaments in different stages of growth. Above are two mature "summer spores" one of which is represented as just detached from its support. These propagate the fungus through the summer and autumn. 2, Shows one germinating. U. S. Dept. of Agr. Rep. 1886, p. 136.

are formed. These infect other pods. Soon after the pods set spray with sulphide of potassium and repeat the operation when they are half or two-thirds grown, and again ten days later. Thin the plants, drain the soil,

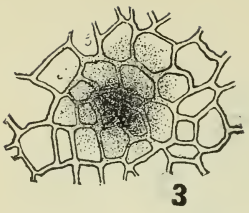


FIG. 20. 3, Grape skin on which the "fungus threads" have grown. Much enlarged. These mycelia on the berry are visible to the unaided eye as brown lines or blotches.

and select a dry and airy site for the bean plot. Carefully burn all diseased pods and vines.

DISEASES OF CURRANTS.

Anthracnose (*Glæosporium ribis*, M. & D.) appears on the leaves in June as small dark brown spots which increase rapidly. The leaves turn yellow, begin falling before the middle of July and early in August the bushes are bare, the fruit also shrivels and drops off. Spray in June with Bordeaux mixture.* Leaf-spot (*Septoria ribis* Desm.) Early in June spray with Bordeaux mixture. In bad cases four or five applications should be made.

DISEASES OF GOOSEBERRIES.

For leaf-spot and anthracnose treat as above. Mildew, (*Sphærotheca mors-uvæ*, B & C) first appears like cobwebs on the young half-grown leaves but soon becomes white and powdery. Then thin patches appear on the berries, spread and become dark colored finally producing spores. Manuring, mulching the roots, high culture and pruning are preventives. Dust the bushes with flour of sulphur as soon as the first leaves are formed, and repeat the operation every ten days during the rapid growth of canes. Try spraying with sulphide of potassium. (See grape.)

DISEASES OF THE APPLE. †

Scab (*Fusicladium dendriticum*, Fckl.) causes great damage as its attacks are persistent and heroic treatment is required to free an infested orchard. The scab forms dark, livid, velvety patches upon the surface of the leaves and fruit checking their growth; causing the fruit to become distorted and knotty, cracking the surface and rendering it unfit for market. The foliage is seldom seriously injured. Infection takes place both from the fungus wintering upon the twigs and from spores remaining on old leaves and decaying fruit which should be carefully removed.

Bitter rot or birds-eye rot (*Glaeosporium fructigenum*, Berk.) occurs only on the fruit appearing as small circular spots of pale brown slightly sunken tissue with a smooth surface. These increase in size and soon become softened as the decay extends deeper into the apple. The fungus reproduces rapidly by means of spores borne on the diseased area. Hogs should be put in the orchard to destroy all infected fruit as it falls.

Brown rot appears on the leaves as small circular spots with a straw-colored centre. These rapidly enlarge and coalesce making large areas of diseased tissue. The diseased leaves remaining on the ground over winter are the chief source of infection and should be carefully raked up and burned.

Rust occurs on the foliage in early summer and may be distinguished by the circular orange-colored spots which sometimes coalesce, covering

* W. R. Dudley, Cornell Ex. Sta. Bul. No. 15, Dec. 1889, pp. 196-98.

† Wm. B. Alwood, Va. Ex Sta. Bul. No. 17, June 1892, pp. 59-66 W. J. Green, O. Ex. Sta. Bul. No. 9, Vol. IV, Dec. 1891, pp. 193-212.

the leaf surface and eventually destroying it. The under side of the spot shows at maturity small cup-shaped bodies which bear spores. This rust is the summer stage of the Cedar-apple which grows on the Juniper and Cedar and from which alone infection is to be feared as spores borne on apple leaves will not reinfect them. Where practicable the Cedars should be cut down or the galls removed before the spores mature.† For twig blight see pear.

TREATMENT.

In early spring before the buds open spray trees with lye which will destroy the many fungus spores lodging on the branches. Just after the bloom has fallen spray with weak Bordeaux mixture. About 20 days later

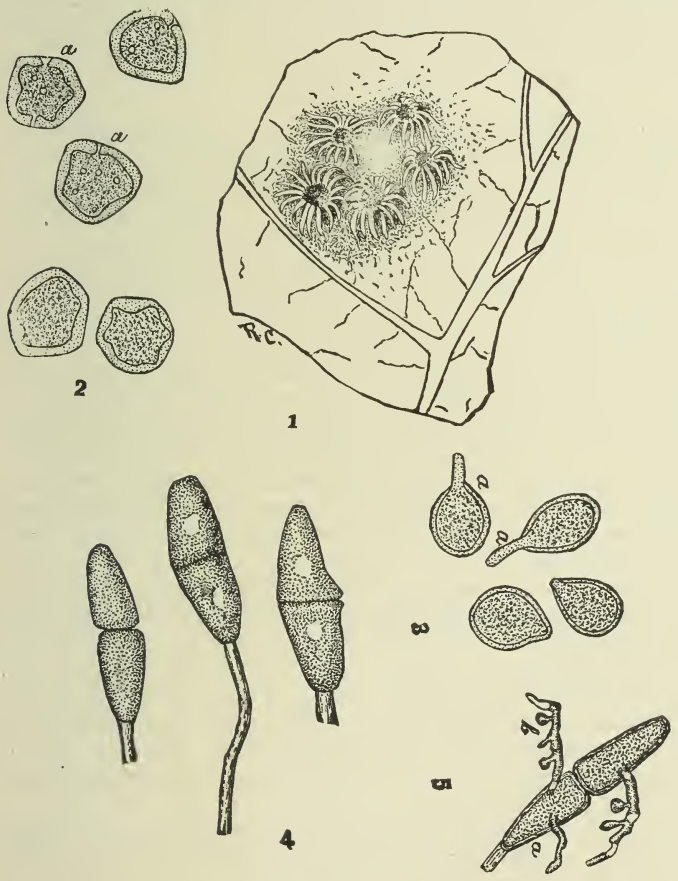


FIG. 21. Apple Rust. 1. Fragment of leaf, showing the under side with the "cluster cups" containing æcidia spores. 2, and 3, Germinating æcidia. 4, and 5, Germinating spores of "Cedar apple" (Gymnosporangium.) U, S. Dept. of Agr. Rep. 1888. p. 403.

† Dr. Roland Thaxter, Conn. Ex. Sta. Bul. No. 107, April 1891, p. 2-3.

spray again to prevent the brown rot which makes three attacks in a summer. About the middle of July spray with copper carbonate to prevent the bitter rot.

DISEASES OF THE PEAR.

Fire blight of pears, apples aud quinces is caused by a minute germ (*Micrococcus amylivorus*, Burrill) which multiplies rapidly in the tissues of the plant whenever its vitality is lowered. The first cause is probably disease seed, then perhaps the seedlings are budded or grafted from blighted trees, at all events the bacteria are in the plant awaiting an opportunity to develop. The attack usually comes on rapidily as a sudden withering of the wood and bark preceeded by a blackening of the leaves, and may confine itself to one limb or rapidly involve the whole tree. It is often brought on by overcrowding or starving the trees and may then be averted by thinning them. If the land is damp or wet it should be drained thus lessening the danger of blight. Never crop an orchard when affected with blight.‡

When a tree blights remove, and burn at once outside the orchard, every trace of diseased wood. Saw off the smaller branches about a foot below the least sign of disease, and dig out the spots on the trunk and larger limbs cutting deep enough to remove all discoloration. The knife and saw, used in pruning should always be disinfected with carbolic acid before leaving each tree to avoid infecting the freshly cut healthy wood of the next tree. The exposed surfaces should be at once painted to exclude germs that may be floating in the air.

Pear rust (*Roestelia pirata*, Thax.) When the fruit is very small fine fungus threads grow through it distorting the pear and replacing the green color by orange. In these red patches small pimples appear, enlarge and produce short tubes containing an immense number of bright orange spores which fall out and are carried away by the wind at maturity. Later the distorted fruit hardens and falls to the ground or remains hanging to spread the disease. The only remedies are the axe and pruning knife. Destroy at once all diseased fruit, also Cedar apples to prevent their spores reaching healthy trees.

Leaf blight (*Entomosporium maculatum*, Tul.) appears on the leaves in June and July as small brown spots which spread rapidly discoloring the leaves stopping their growth and causing them to fall. It also causes the fruit to crack, and destroys tender twigs. Great injury is done to the seedlings in the nursery, the standard being weakened so that grafting will not succeed.§ Get a vigorous growth of trees before midsummer and spray with Bordeaux mixture. The first application should be made when the leaves are half grown and repeated every 3 or 4 weeks during the season.

Prof. Chester recommends‖ this solution for spraying; mix 3 ounces of copper carbonate with one pound of pulverized carbonate of ammonia, dissolve in 2 quarts of water and dilute to 50 gallons.

‡ J. J. Black, Cultivation of the Peach and Pear 1886, pp. 272, 281-85.
§ W. R. Dudley, Cornell Ex. Sta. Bul. No. 15, Dec. 1889, pp. 198-99.
‖ Rep. Del. Ex, Sta. 1891, quoted by Prof. Harvey in Me. Ex. Sta. Rep. pp. 109-11.

DISEASES OF THE QUINCE.

Fruit spot. (*Entomosporium maculatum*, Lev.) When quinces or pears are nearly grown small brown spots appear, which enlarge run together and turn black. The decay is superficial and the fruit though stunted can be used. The leaves become spotted and soon fall leaving the branches bare. Spray with copper carbonate or eau celeste. For leaf blight see pear.

DISEASES OF THE PLUM.

The spores of Plum wart (*Plowrightia morbosa*, Sacc.) germinate on the bark of plum and cherry trees, penetrate it, and feed upon the soft tissues of the branches. The growth of the fungus and that of the tree in its effort to overcome the injury causes the enlargement known as the black knot. Cut off and burn diseased branches. Cut out the young knots. Wet them thoroughly with linseed oil, turpentine or kerosene, taking care not to injure the sound wood. Make three applications during the summer.

Fruit rot: Spray with Bordeaux mixture or copper carbonate. (See Peach). For leaf-spot and blight see cherry. For mildew see apple.

Plum pockets (*Exoascus pruni*, Fckl.) distort the fruit and cause the tips of branches to swell and die. Remove and burn immediately all fallen and diseased fruit. Spray with Bordeaux mixture to prevent germination of spores.

DISEASES OF THE CHERRY.

The Shot-hole fungus (*Cylindrosporium padi*, K.) penetrates the entire leaf but congregates in spots to produce spores. Here the tissue dies, becomes brittle and soon breaks away riddling the leaves which turn yellow and fall prematurely. Spray with Bordeaux mixture or ammoniacal copper carbonate about June 1st and every three weeks thereafter if the disease is bad. For fruit rot see peach. For black knot see plum. For mildew see apple. For Leaf blight spray with ammoniacal copper carbonate. (See pear).

DISEASES OF THE PEACH. *

Of the many diseases affecting the peach—curl, yellows, rot, blight, mildew, etc.—none attack the trees until they have in some way become weakened so the weakening causes should be sought out and removed as the remedy will then prove more effective. Peaches need a light soil and equable climate. They are apt to become blighted on wet heavy soil when overcrowded and without sufficient nourishment. In such situations the rot (*Monilia fructigena*, Pers.) frequently does much damage by causing the fruit to lose its color and flavor, turn leather colored, and finally rot, rapidly destroying from ½ to ¾ of the crop. The earlier thin skinned varieties are said to suffer most. The decaying peaches should be removed and burned immediately and not be allowed to remain on the trees over winter as they bear the spores from which young peaches are infected in the spring.

When this appears in the twigs it is called BLIGHT and the direct injury usually occurs near the point of attachment of the peach where the tissues are browned and killed by the parasite. Sometimes this and the mildew (*Erysiphe* sp.), which consists in a thin whitish covering over the leaves causing their decay and death, may be found together. Cut off and burn the

* E. F. Smith, Journ. of Mycol. Vol. V No. 3 pp. 123-34. and U. S. Dept. of Agr. Rep. 1888, pp. 393-8. B. D. Halsted, N. J. Ex. Sta. Rep. 1892, p. 339.

diseased branches. Spray with sulphide of potassium, or dust with sulphur. Bordeaux mixture will check the mildew. Prevent the disease from spreading by carefully examining the trees and if any rotted fruit and blighted twigs are found remove and burn them immediately. For leaf spot see cherry.

PEACH YELLOWS.

The peaches on diseased limbs or trees ripen prematurely, the sound fruit being only half grown. The fruit is red or purple-spotted without and streaked within. Soon diseased dwarfed growths, bearing red, yellow or white diminutive leaves, appear on the branches. These shoots tend to branch repeatedly. The disease usually appears in one branch gradually spreading till in two or three years the entire tree is diseased and dies, or it may languish dying from the extremities downward.

The cause of yellows is unknown. It has been attributed to sudden changes of temperature, to excessive rainfall, to an impoverished soil, to the effects of parasites, and by some to a germ. No remedy is known.— Promptly remove and completely burn all diseased trees on the first appearance of yellows. Procure trees from localities free from the disease. When replanting many prefer to set trees in a new place. The peach is very sensitive to frost, and chilling winds render it more susceptible to attacks of curl-leaf (*Taphrina deformans*, Tul.) for which no remedy is known. Keep the trees as vigorous as possible. Destroy infected trees or at least remove and burn diseased parts.

STRAWBERRY LEAF-BLIGHT.

Blight (*Sphaerella fragariae*, Tul.) usually causes its greatest injury by attacking the new growth which appears after the fruit is harvested. The old leaves then contain countless spores which will infect the young growing foliage. To prevent this mow the plants with a scythe, rake up all the leaves, allow them to dry and then burn carefully. Some recommend renewing the settings annually and planting in deep well drained soil. Spray with ammoniacal copper carbonate every fortnight beginning the latter part of April. Four applications should be sufficient.

DISEASES OF THE ROSE.

Mildew (*Sphaerotheca pannosa*, Wallr.) often develops suddenly giving the foliage a misshapen, powdery appearance. Spray with potassium sulphide. Evaporate sulphur with due caution.

Black-spot (*Actinomena rosae*, Fr.) produces characteristic black spots on the leaves which become pale and soon fall. Gather up and burn the fallen leaves. Spray with copper carbonate.

DISEASES OF CELERY.

Leaf-blight (*Cercospora apii*, Fr.) causes a peculiar yellowish appearance of the foliage which is soon ruined. Shelter the plants from the sun by cloth or lath screens. Destroy the old leaves and stems on which the fungus lives over winter. Spray the young seedlings with ammoniacal copper carbonate twice a week till they are removed from the seed bed and later if necessary. Dirt falling into the heart of the plant produces rot. The rust and bacterial disease can probably be checked by spraying. *

* Rep. Dept. Agr. 1886 p. 119., 1888 p. 398. Rep. N. J. Ex. Sta. 1891 pp. 250-9.

Lettuce Mildew (*Peronospora gangliformis*, D. By.) Good drainage and abundant sunlight are preventives. Evaporated sulphur carefully used is an effective remedy.

DISEASES OF THE POTATO.

Potato rot (*Phythopthora infestans*, D. By.) passes the winter as spores on the old vines and as mycelia in the tubers. Carefully examine all seed potatoes and reject those that are diseased. Burn the vines as soon as the crop has been dug. Do not raise two successive crops of potatoes in the same field. Spray the vines with Bordeaux mixture when half-grown, again when they are in bloom and once or twice afterwards.

Scab (*Oospora scabies*,) may be prevented by planting healthy tubers in soil where diseased beets and potatoes have not grown. Soak the tubers 1½ hours in corrosive sublimate before planting.

DISEASES OF THE TOMATO.

Anthracnose (*Colletotrichum lycopersici*, C.) attacks the ripening tomato at the point where it has begun to color and spreads rapidly, causing much loss before the fruit can be marketed. It appears as sunken discolored spots with a dark centre, these increase in size, run together, cover a large portion of the decaying fruit and are surrounded by wrinkled, discolored skin. Spray the vines and young fruit early in the season with potassium sulphide.

In southern or field blight the leaves become yellowish and curled, the ends shrivel and droop, finally becoming dry and black. Gather and burn all diseased vines and fruit in the fall. Change the tomato patch to another field for two or three years.

THE DODDERS.

The dodders are leafless annual herbs with thread-like yellow stems rising from the ground and becoming parasitic on the bark of herbs and shrubs on which they twine and to which they adhere by means of suckers through which they draw juices from the plant.* The lower part of the stem then dies, but the threads develop until a circular patch of flax or alfalfa is covered by the dodder and becomes so weakened that it turns brown and dies.

Plant only pure seed and never save an infested crop for seed. Dodder seeds are similar to those of clover but can be separated by careful screening. If the meadow is slightly infested, mow and destroy the affected patches as soon as seen and if no plants are allowed to seed the crop may be saved. If, however, the meadow is full of dodder, plow up the flax or alfalfa and plant other crops for a few years when all the dodder seeds will have germinated and died for want of a suitable host on which to feed.‡

ONION MOULD.

Mould (*Peronospora schleideniana*, D. By.) appears as a grey velvety outgrowth on the upper part of the leaves in June and July causing them to become pallid and shrivel. The plants die when the bulbs are from ½ to 1 inch in diameter. Never set bulbs from a diseased crop. Try spraying with Bordeaux mixture.

* Gray's Man. of Botany, 6th Ed. 1892, p. 371.
‡ Geo. Vasey, U. S. Dept. of Agr. Rep. 1886, p 72.



FIG. 22. Smut of Indian corn. Portion of smutty ear; at the base are some sound grains(*g*); above them, the female flowers remain sterile (*s*), and the bracts (*c*, *c*) are swollen and made numerous by the fungus developed there and in the abortive ovaries. U. S. Dept. of Agr. Rep. 1887 p.396.

GRAIN SMUT.

The smuts (*Ustilagineae*) are internal parasites developing entirely within the tissues of their hosts. Grain smut[*Ustilago segetum*, Pers.] appears on the fruiting heads of cereals completely replacing the seed and when ripe presents a characteristic mass of black spores. ‡ The seed coats burst open and the spores are scattered in all directions by the wind, lodging on the surrounding plants and soil. Fortunately, these cannot infect healthy neighboring plants. It is useless to attempt to save a plant once attacked but prevention is both cheap and effective. First, kill the adhering spores by soaking the grain, for a short time, before sowing in a solution of copper sulphate using one pound to 25 gallons of water. It may then be spread out to dry or dusted with plaster. Second, lessen the liability to smut by having healthy plants. Sow good ripe seed at the proper time on well prepared and drained land. Avoid animal manures as they are liable to contain smut spores.

‡ W. A. Kellerman, Kan. Ex. Sta Rep. 1889, p. 217-18.

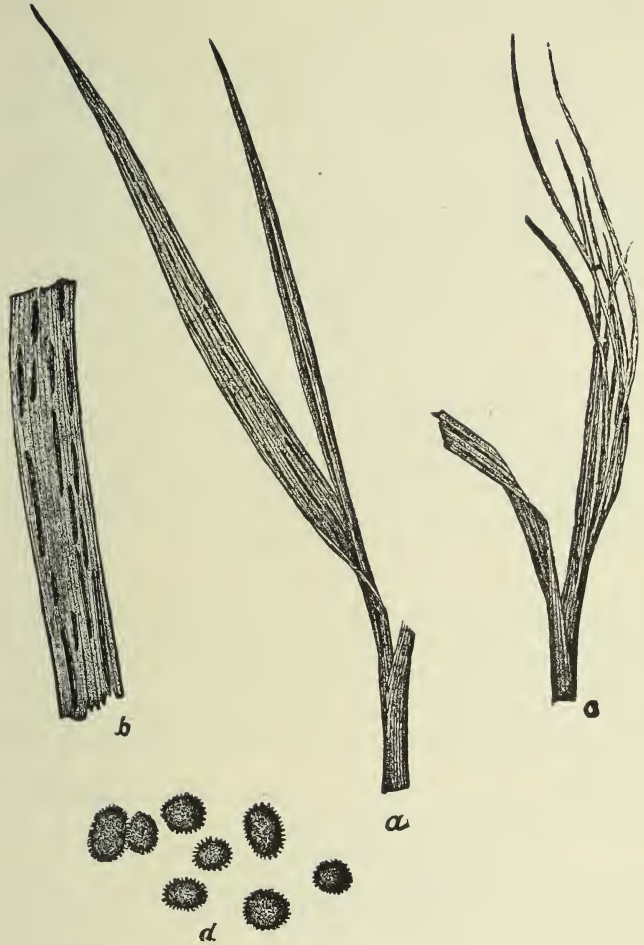


FIG. 23, Wheat Rust.

WHEAT RUST.

Wheat rust [*Puccinia graminis*, Pers.] is a good example of the rust group [*Uredineae*,] because its life-history shows four well marked stages.

I. In the spring clusters of small, yellow cups break through the outer covering of barberry leaves. They are filled with rounded masses which drop out and are carried away by the wind. This is the first or "cluster-cup" stage.

II. When these spores fall upon a wheat leaf they germinate and their root-like threads penetrate its tissues abstracting nourishment from the plant. In a few days the parasite has become sufficiently mature to form

large red spores which appear as reddish lines or spots upon the leaves and stems. This is the second or "red rust" stage.

III. Later in the season the same fungus which produced the red rust spores give off the spores of a black rust called "resting spores" because the fungus lives over winter in this form. This is the third or "black-rust" stage.

IV. In the spring these germinate on decaying straw, producing minute spores which fall upon the barberry leaves, producing cluster-cups and thus completing the cycle of their existence. One of these stages is sometimes skipped where the barberry is absent. *

Destroy wild barberry bushes [Oregon grape] in the fence corners. Plant wheat early. Select varieties that have hard flinty straw. Fertilize fields with potash and phosphates which produce a hard straw.†

Such is an imperfect account of the more important plant diseases and the author hopes it will subserve the purpose for which it was prepared. The general methods of treatment given will apply to most cases of disease. For some diseases there is an effective and practicable remedy while for others none has as yet been discovered but the Experiment Stations are now investigating this subject and let us hope they will find a cure for all the diseases that now trouble our farms and orchards.

ACKNOWLEDGEMENTS.

We take this opportunity to thank those who have aided the Station by sending specimens of plants growing in their vicinity and answering questions regarding their flora. It is through such friendly co-operation in Station work that the best results can be accomplished, as it is impossible for the Botanist to individually visit all portions of the State and make a study of the noxious weeds, injurious fungi, etc., without neglecting his classes at the College.

I desire to express my obligations to the U. S. Department of Agriculture for the electro-types used in this bulletin.

HOW TO SEND PLANTS FOR IDENTIFICATION.

Remember that the Experiment Station was established for your benefit so if you desire information concerning plants growing on your farm or about any plant disease write to us and your questions will be answered as fully as possible. Questions about plants should be accompanied by specimens, so we may know just what one is meant. The fragmentary or imperfect specimens often sent to botanists for identification are so annoying that it is necessary to state what is needed to correctly determine a plant.

The specimens should be complete, that is, they should include the flowers, fruit, leaves and if herbaceous a portion of the root; often the lower or root leaves are different from the stem leaves, so both should be sent. Of woody plants a shoot six or eight inches long bearing leaves and flowers and accompanied by the fruit, if possible, will be sufficient. All specimens

* C. E. Bessy, Advanced Botany, 7th Ed. 1892, p. 316. C. B. Plowright, British Uredineæ and Ustilagineæ, 1888, p. 34.
† N. Car. Ex. Sta. Bul. No. 76, p. 16-7.

should represent the typical form except when the object is to show some abnormal growth. Send plenty of material.

Plants may be preserved by placing them under pressure between sheets of newspaper immediately after gathering, changing the driers every day for four or five days, after which the specimens will keep indefinitely. Number them wrapping each species separately in old newspapers, and send in an unsealed package with your name and address, preceded by the word *from*, plainly written on the outside. The postage is one cent an ounce which must be fully prepaid or the package will not be forwarded. In the accompaning letter state the date and place of collection and whether the plant is considered medicinal, poisonous or weedy, with any other information you consider of interest.

Address all communications regarding plants to

MOSES CRAIG,
Experiment Station,
Corvallis, Or.

A. E. S.
March 26, '94

Oregon Agricultural Experiment Station

Bulletin No. 28. January, 1894.

AGRICULTURE.

Continuation of Experiments in Pig Feeding.

H. T. FRENCH,
Agriculturist.

C. D. THOMPSON,
Foreman of Farm.

The Bulletins of this Station are sent free to all residents of Oregon who request them.

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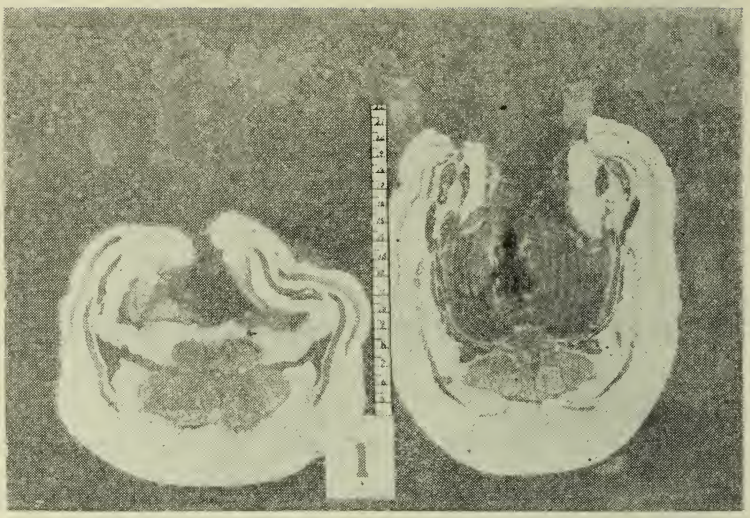
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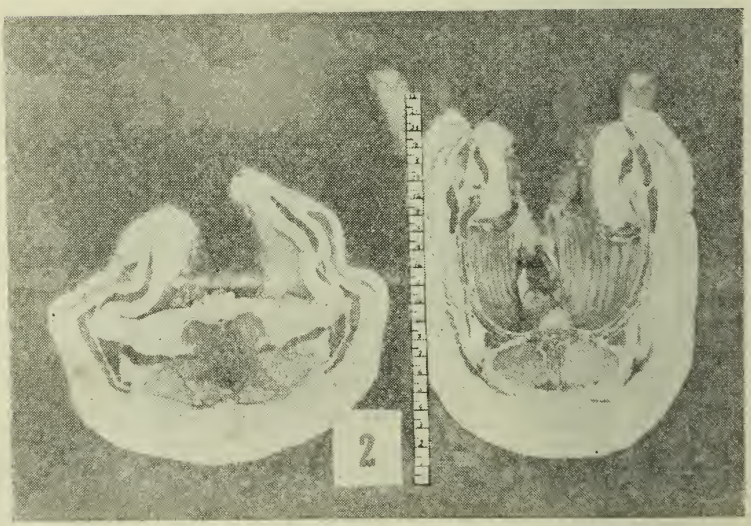
Reports on Experiments in Pig Feeding.

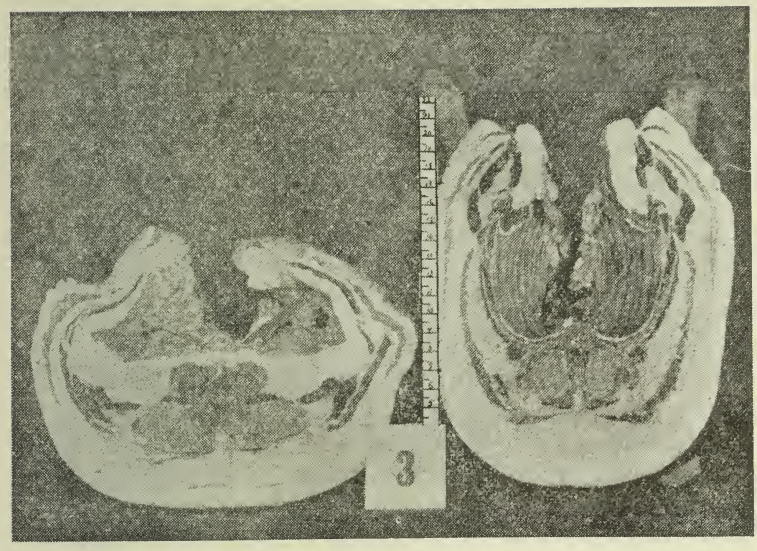
EXPERIMENT NO. 2.

The details, connected with the work in experimenting on the methods of pig feeding, are set forth in this Bulletin, with the same object in view, as mentioned in Bulletin No. 20, to wit: that of establishing, if possible, the fact that pork can be successfully and profitably produced on the farms of Oregon, without the aid of corn. Where corn can be grown, as in some of the southern counties of the state, it will continue to be one of the chief food materials for fattening swine; but over a large portion of the State, it will never become of great importance in this work, owing to climatic conditions which hinder its growth and maturity. The results are such as to dispel all doubts from the minds of those who have thought that wheat could not be made to produce pork, equal in quality to corn fed pork. From the cuts made from photographs, which appear in this Bulletin, it will be seen that the fat is very heavy and thick; and, although not shown by the cuts, it is very firm in texture.

The lean meat was very juicy, and light in color, which characteristic has marked all of the results in feeding wheat to pigs, thus far carried on at our station. In the rate of gain produced, the results will compare favorably with those obtained from feeding corn. By referring to the table, showing results by periods, it will be seen that during the first period it required a larger amount of grain, to produce a pound


1


2


3


4

of gain in lot 1, than in lot 2; and this is the only period during which this is true. It was very noticeable also that the pigs did not enjoy the pure chopped oats. This fact was noted in previous experiments. The pigs do not like the coarse hulls which are present in such abundance in chopped oats. During the second period chopped wheat was substituted for the oats, and there is a much better showing in favor of this material.

During this period, there was 13½ pounds of gain, for each bushel of wheat consumed. This is a significant fact, to those who are discussing the practicability of feeding wheat to pigs, instead of selling at present prices. During the third period, there was a slight increase in the amount of food required, to make a pound of gain in lot 1; but a still larger increase is required in case of the mixture. In this experiment, the mixture has not given as good results, as we had been led to expect from published reports of similar work. Our conclusion from present experience would be that, unless we can substitute a cheaper substance for a portion of the ration, that a mixture is not especially desirable in fattening pigs..

During the fourth period, the difference is still greater in favor of the chopped wheat. Lot 2 made very small gains, during the last period. The pigs in this lot, had passed the point of profitable feeding at the end of the third period. They did not get about as well as those in lot 1, after this time. Had they been slaughtered at the end of this period, there would have been less difference in favor of the wheat, in the amount of food required to make a pound of gain. Taking an average of the several periods we find that it required, 5.02 pounds of grain to make a pound of gain in lot 1; and 6.12 pounds in lot 2.

In round numbers lot 1 consumed 2447½ pounds of grain, at a cost of $19.41, or 3.9 cents for each pound of gain in live weight. In this case wheat was valued at 45 cents per bushel, the price paid at the time of threshing the grain. Oats were reckoned at 36 cents per bushel.

Lot 2 consumed 2325 pounds of grain, which figures the same as in lot 1, $19.41, or 4.66 cents for each pound of gain in live weight. The latter increase per pound, is due to a smaller total gain in live weight. Wheat and oats were figured at the same price, as in lot 1; and the bran at 75 cents per cwt.

and shorts at 90 cents. These prices make the by-products, bran and shorts cost more than wheat, which is the case at the present time.

As to the profits, lot 1 makes a very good showing; and there is no loss in lot 2, at a cost of 4.66 cents per pound of gain, with pork at 5 cents gross. With the small percent of shrinkage, as shown in table 5, the profits were materially increased by dressing and selling at 6½ cents, which was easily obtained at the time of slaughtering.

The quality of the meat was all that could be desired in fat pork. There was a good thickness of fat, and at the same time a good distribution of lean meat. The meat was pronounced excellent, by all who had the pleasure of testing it.

The pigs were only eleven months old at the time of slaughtering. In lot 1, they made an average gain of 1.4 pounds per day from birth, while those in lot 2, made 1.3 from birth.

Previous to the experimental feeding the pigs were fed slops from the kitchen with a few shorts added. No effort was made to crowd them but simply to keep up a healthy and vigorous growth. The pigs were not permitted to run to pasture at any time. Small yards, in which the pigs can get to the ground, were connected with the pens. The pigs were fed twice each day, at eight in the morning, and five in the evening. Each ration was weighed out and allowed to soak until the time for the next feed. A handful of salt was added to each feed. Charcoal was given to them as they required a shovel full twice a week.

The breed of pigs used in this feeding test, was a cross of the Poland China and Berkshire, with the Berkshire predominating. The pigs were purchased for the experiment, and no definite knowledge could be ascertained as to their exact breeding. They were taken from a litter of nine and, at the beginning of the experimental feeding, were very uniform in size. This is shown in table giving weights at the beginning of the work.

Half-tone engravings of the meat are presented with these notes. These pictures will give a very good, and necessarily a true representation of the meat, as it appeared upon the block. The cuts were made through the loin, and between the 6th and 7th ribs. Nos. 1 and 2 are from lot 1, and Nos. 3 and 4 from lot 2. The Photo-engravings were made by Prof. E. F. Pernot, who is connected with this Station.

TABLES

Showing weight of pigs and amount of food consumed to make a pound of gain in periods of 4 weeks each..

Table 1.—First Period.

Name of Pig.	No. of Lot	Date of weighing. Sep. 1	Sep. 8	Sep. 15	Sep. 22	Sep. 29	Total gain.	Total food consumed.	Amt. food to make 1 lb gain.	Remarks.
Sam.....	1	216½	226½	244	254	266	49½	425½	4.75	Chopped Oats.
Tom.....	1	238	241	262½	267½	278	40			
Dick.....	2	215½	228½	253	270	281½	66	532½	3.87	Mix. chop'd oats wheat sh r s bran
Harry.....	2	239½	254½	279½	288	311	71½			

Table 2.—Second Period.

		Sep 29	Oct. 6	Oct 13	Oct 20	Oct 27				
Sam.....	1	266	286½	308	328½	339	73	653¼	4.44	Chopped wheat.
Tom.....	1	278	291½	327½	337	352	74			
Dick.....	2	281½	291½	314	328½	340½	59	654½	5.25	Same as preceding period.
Harry	2	311	327½	347½	366½	376½	65½			

Table 3.—Third Period.

		Oct 27	Nov 3	Nov 10	Nov 17	Nov 24				
Sam	1	339	364½	372	392½	411	72	687½	4.94	Chopped wheat.
Tom.....	1	352	375	382	402½	419	67			
Dick.....	2	340½	351½	362	371	379	38½	601	6.35	Mixt. chp'd oats wheat & shorts.
Harry	2	376½	394½	404	417½	432½	56			

Table 4.—Fourth Period.

		Nov 24	Dc. 1	Dc. 8	Dc. 15	Dc. 22				
Sam	1	411	425	444½	459	469½	58½	681	5.97	Chopped wheat
Tom.....	1	417	434	452	468	472	55½			
Dick.....	2	379	378½	393	402½	403	24	537¼	9.03	Mixt. chp'd oats wheat & shorts.
Harry	2	432½	435	452½	465	468	35½			

Table 5, showing weight of various organs, live weight, dressed weight, after hanging 24 hours, and per cent of shrinkage.

	Chopped wheat and oats				Mixture wheat oats shorts and bran.			
No. of pig as shown in cut	Sam. 1		Tom. 2		Dick. 3		Harry. 4	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
Live weight	463		472½		453½		396½	
Dressed weight	404		406		384½		337½	
Amount shrinkage	59		66½		69		59	
Blood	8	9	7	14	9	10	9	8
Hair	3	6	3	14	4	12	3	15
Lungs	4	6	4	1	4	3	3	3
Spleen		7		6		8		6
Heart		17		10		16		14
Intestines	29	8	33	10	34	1	30	12
Bladder and Urethra		14		13	1	2		16
Kidneys		13	1	3	1	2	1	
Tongue		13		8		16		13
Liver	4	3	4	11	5	6	3	15
Leaf Fat	18	11	23	7	21	10	18	13
Gut Fat	12	13	14	3	14	15	11	12
Per cent shrinkage	12.7		14.0		15.2		14.9	

Average per cent shrinkage 13. per cent. 15. per cent.

Experiment No. 3.

This experiment was carried on, with a view of throwing some light upon the comparative value of wet and dry feed, in fattening pigs. Questions regarding the merits of these methods, have often been asked by the farmers of this State, hence the work was undertaken for the porpose of assisting at least, in solving the problem. Indirectly, this experiment will throw some light upon the question of pork production, as a source of profit to the farmers of Oregon.

CONDITIONS OF THE EXPERIMENTS.

Four well bred, Berkshire pigs were purchased, when about four weeks old for this feeding test. The feeding was begun July 1st, 1893. The pigs were 2½ months old, when a record of the food began to be made, and they were weighed from this time, at regular interval of two weeks.

It will be seen, by referring to table 1, that there was only three pounds difference, in the weight of the pigs placed in each pen, at the beginning of the experiment. The pigs were of the same litter, and a sow and barrow was placed in each pen.

Previous to the experimental feeding, the pigs were fed on slops from the kitchen and shorts added, as they required. no special effort was made to crowd them, but simply to keep them in a vigorous growing condition.

Pen No 1 was fed on shorts, from July 1st, to Sept. 5th, at which time the food was changed to chopped wheat, oats, bran, and shorts, ¼ each by night. At the time the change was made, the pigs were very weak on their feet, They were loth to stand long enough to eat their feed. Soon after the change was made the difficulty disappeared, and no more trouble was experienced, during all of the time the animals were fed.

Our conclusions were, that the slops and shorts did not furnish enough bone forming substances, or if such substances were present, the animals were not able to assimilate a sufficient amount to strengthen the bones of the limbs.

All of the food given to the pigs in pen No. 1, was given to them dry, and the water was placed near by in a separate trough. Fresh water was placed in the trough every time the pigs were

fed. The pigs in this pen drank more water, than those in pen No. 2, including the water used in wetting the feed.

Pen No. 2, was fed on the same kind of food, and under exactly the same conditions, as Pen No. 1, except each ration was thoroughly wet with cold water, and allowed to stand from one feeding time to the next. The amount fed was governed by the appetite of the pigs. Each lot was given all they would eat, without leaving the food to stand in the trough too much. Every ration was weighed as it was fed. The food was placed in the troughs at eight o'clock in the morning, and five in the evening. These hours of feeding were strictly adhered to, for we believe that the best results in feeding any kind of stock, can be realized only when regularity, in the feeding and care of the animals, prevails.

Charcoal and ashes, were placed in the pens two or three times a week as required. The pigs were permitted to run in small yards, which were connected with the pens.

RESULTS.

From the out-set, the pigs fed on the wet feed, seemed to relish their food better than those fed on dry. Seemingly, it did not require so much effort on their part to eat their ration, as it did the dry fed lot. The pigs fed on wet food, would eat their feed in much less time than the others.

In the tables showing results by periods of two months each, it will be seen that, during the first period, Pen No. 2, gained 16½ pounds more than pen No 1, upon 7½ pounds less of food. During the second period, shown in table No 2, the gain is 21 pounds, but at the expense of 87½ pounds more of food, than that consumed by Pen No 1. Yet, during this period the amount of feed required to make a pound of gain, is not as large as that required in some experiments, where corn was used as the principal food material. In the third period, or during the last two months, Pen No. 2 made 35 pounds more gain, than Pen No. 1, and consumed 122 pounds more of grain. One of the pigs in pen No. 1, did not make as good gains as the other by 44 pounds. This pig seemed to drop off in the amount of food eaten, and from all indications it had passed the point of profitable feeding.

By averaging the several periods we find, that it required

4.64 pounds of food to make a pound of gain in live weight in pen No. 1, or the dry fed lot, and 4.46 pounds in pen No. 2, or those fed on wet food

Both of the results are more encouraging than any we have reached before in our feeding experiments.

They are such as to insure a profit in feeding grain to pigs, at the present prices paid for pork, and grain products. We take it for granted that the grain is fed to good animals, and in a judicious manner. By judicious manner, we do not mean that the grain should be fed whole, in an open yard on the ground, or in the mud. Such conditions never prevail in Oregon; but they do occur in some of the neighboring States, it is safe to venture; and, possibly, in some of the Eastern States.

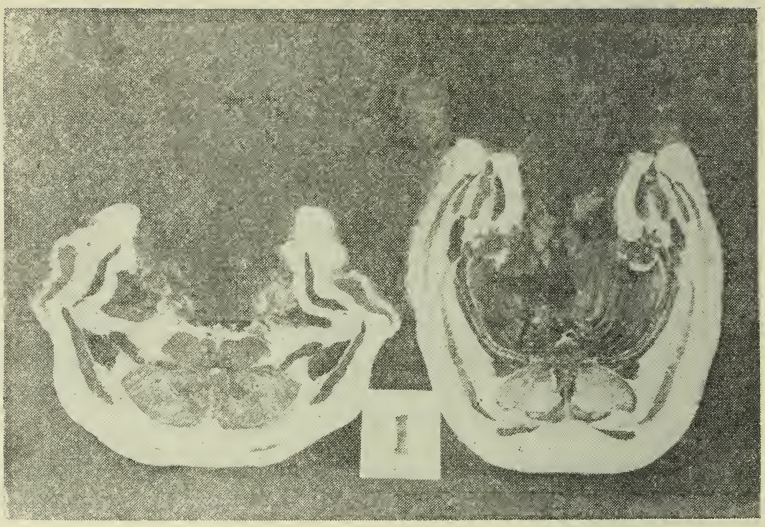
The pig appreciates good quarters and will pay for such accomodations in an increased product, just as quickly as any other breed of live stock.

These figures would indicate, that Oregon can successfully compete with the corn growing States, in producing a supply of these products sufficient at least to meet the demands of her own markets. And may she not supply the markets of this coast, that are now supplied from States east of the Rocky Mountains?

Lard has retailed, in the markets of Oregon, during a large portion of the past year, at from 15 to 17½ cents per pound. Wheat has been selling at from 45 to 60 cents per bushel. A bushel of wheat, as shown in the first part of this report, produced over twelve pounds of gain in live weight. We will leave the reader to draw his own conclusions.

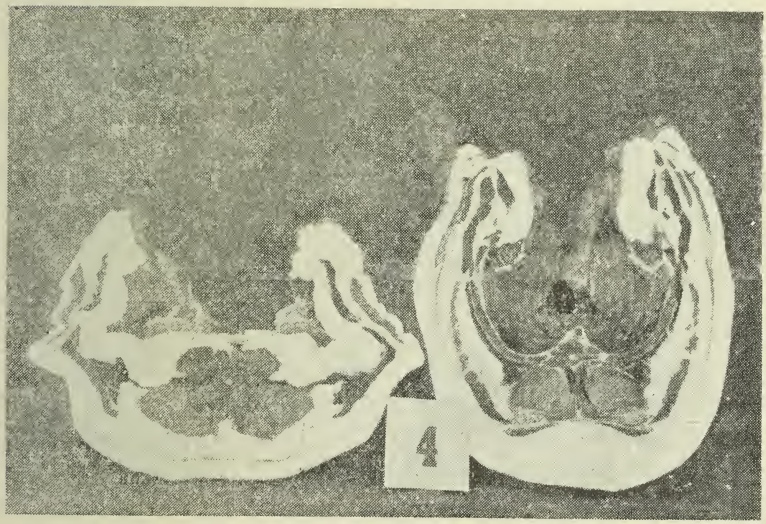
In the table giving the summary, the cost of the food to produce a pound of live weight is given. In these figures, Shorts have been reckoned at $18.00 per ton, Bran $14.00, Oats 30 cents per bushel, and Wheat 45 cents. Shorts at the present time are quoted at $16.00 per ton.

Pen No. 1 consumed 1142½ pounds of shorts, 197 of bran, 323½ of chopped oats, and 459½ of chopped wheat. Pen No. 2 used 1215½ pounds of shorts, 210 of bran, 368 of chopped oats, and 526 of chopped wheat.


1


2


3


4

Tables showing results by periods of two months each.

Table No. 1.—First Period.

	Dry shorts Pen No. 1		Wet shorts Pen No. 2.	
No. of Pig	1	2	3	4
Date of weighing.	lbs	lbs	lbs	lbs
July 1st	57	68¼	62½	60
July 15th	84	101	92½	94
July 29th	102	123	115½	118
August 12th	125	145½	129	139
August 26th	139½	164	158	160
Total gain	82½	95½	95½	100
Total food	588		582½	
Amount of food for a pound of gain	3.3		2.97	

Table No. 2.—Second Period.

No. of Pig	1	2	3	4
	lbs	lbs	lbs	lbs
August 29th	139½	164	158	160
September 9th	153½	177½	168	175
September 23d	166½	195½	186	198½
October 7th	189½	211½	217½	221
October 21st	206	219½	221	240
Total gain	66½	55½	63	80
Total food	624½		712	
Amount of food for a pound of gain	4.73		4.98	

Table No. 3.—Third Period.

No. of Pig	1	2	3	4
	lbs	lbs	lbs	lbs
October 21st	206	219½	221	240
November 4th	223½	235½	240	254½
November 18th	246½	246½	266	276
December 2d	265	256½	287	302½
December 16th	288½	269	309	318
December 30th	304½	274	318	331
Total gain	98¼	54⅓	97	91
Total food	903		1025	
Amount of food for a pound of gain	5.9		5.45	

Table No. 4.—Summary.

	No. of pen.	Wt. July 1st.	Wt. Dec 30.	Total gain.	Average gain per day.	Total food consumed.	Cost ₱ pound of gain.	Remarks.
		lbs	lbs	lbs	lbs			
Sow	1	57	304½	247½	1.35	2115½	3.9c	Shorts @$18 ₱ ton. Bran $14 Oats 30 cents ₱ bu. Wheat 45 cents ₱ bu.
Barrow	1	68½	274	205½	1.12			
Sow	2	62½	318	255½	1.39	2319½	3.6	Pen No. 1 Dry feed. Pen No. 2 Wet feed.
Barrow	2	60	331	271	1.48			

Table No. 5, showing weight of various parts in pounds and ounces, and the per cent of shrinkage after hanging 24 hours.

	Pen No. 1				Pen No. 2			
	Sow.		Barrow.		Sow.		Barrow.	
	lbs	oz	lbs	oz	lbs	oz	lbs	oz
No. of Pig as shown in cuts	1		2		3		4	
*Gross weight	300		274		311		322½	
Net weight	249½		230		258½		266	
Blood	5		5	10	7	4	7	8
Hair	1	14	2	2	1	14	2	
Tongue		8		6		9		6
Liver	4		3	2	3	6	4	3
Heart		9		6		8		9
Lungs	2	6	2	8	2	15	3	5
Spleen		4		2		2		4
Kidneys		11		10		12		9
Intestines	22	9	15		19	5	21	12
Fat from Intestines	6	1	7	6	7	14	11	8
Leaf Fat	13	2	14	8	13		18	
Per cent shrinkage	.167		.160		.169		.175	
Average shrinkage	.163				.172			

*The gross weight was taken 24 hours after feeding.

There is a fraction of a cent, in favor of the wet feed, in the cost of producing a pound of gain. At the end of the first two months, the difference in favor of the wet feed, was much greater. As the feeding progressed this difference gradually became less, on account of the increased amount of material eaten by the pigs fed on wet food. While there is not much in favor of the wet food, on the ground of economy as a whole, yet there is a marked increase, in the growth and weight of the pigs, in favor of this method.

Further experiments will be carried on along this line, with a view of throwing more light upon the subject, thereby enabling the farmers of Oregon, to enter into the work of feeding pigs, with a wider knowledge of the conditions which will largely determine the profits and losses.

In table 5, showing the weight of various organs and parts of the pigs, it will be seen that there is a small per cent. in favor of Pen No. 1 in the shrinkage by dressing. It was remarked by several, that those fed on wet food would shrink much more than the other lot, basing their opionion, upon the apparently much larger amount of abdominal vicera. The difference is not as great however, as this condition indicated before slaughtering.

EARLY MATURITY

The pigs at the time of slaughtering were 8½ months old;

and the average live weight at the close of the feeding, December 30th was 306.8 pounds. This is not a marvelous weight by any means; but it is probably above the average. This fact is mentioned, for the purpose of inducing more interest, if possible, in the matter of early maturity. What might be profit, is complete loss many times, in feeding animals which have been grown, or allowed to come up, and *then* fattened. Proper care and feeding should begin before the animal is born, and continue until it has reached the shambles.

While these thoughts are not new to many, they are too often overlooked by those who ought to heed them most carefully.

Half-tone engravings of the meat, as it appeared on the bench are presented in connection with these notes. Upon examining these cuts it will be seen, that there is a very large per cent of lean meat. The fat was lighter colored, than that produced before; but further than this, there were no special characteristics. Cuts on pages 36 and 37 belong to experiment No 2, and those on pages 44 and 45 to experiment No. 3.

I wish to acknowledge the efficient and pains taking work of Mr. C. D. Thompson, in feeding the animals during the experiment.

H. T. FRENCH
Agriculturist.

May 11, 1894.

Oregon Agricultural Experiment Station

Bulletin No. 29. February, 1894.

HORTICULTURE.

Notes on Vegetables, Fruits, Pruning, etc.

GEORGE COOTE, Horticulturist.

The Bulletins of this Station are sent free to all residents of Oregon who request them.

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Notes on Vegetables, Fruits, Pruning, etc.

CABBAGE.

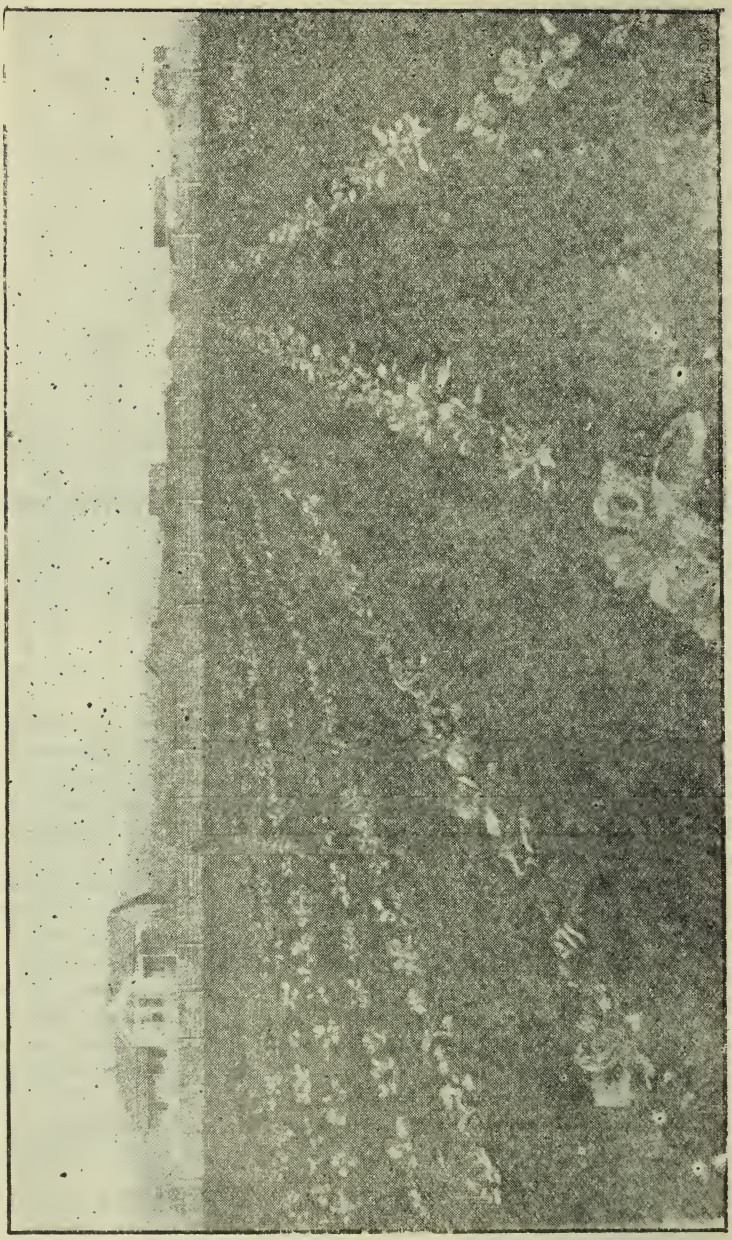
Experiments with different varieties of cabbage, have been made each season during the last three years.

The purpose, the first and second years, was to determine what varieties would best withstand the winters of the Willamette Valley; a report of this was made in Bulletin No. 15. The last season 1892-93 it was thought advisable to further test several early varieties, to prove which were best suited for extra early use, as it was believed that this would be of value to the farmers and gardeners.

Fall planting of cabbage is of great importance in this climate for the reason that it greatly hastens the maturity the following spring, thus enabling the gardener to compete with cabbage shipped from California. In previous trials the seed was sown Sept. 25. Last year, as an experiment, the seed was sown a month earlier, Aug. 25. The experiment proved a success in this, that the first heads matured 28 days earlier than that from seed sown on the 25th of Sept. in previous year, and yet the last season was at least a month later than the previous year. This would indicate a gain of more than a month in ordinary years.

But I would not reccomend that seed should be sown earlier than Aug. 25th, because the plants show a greater tendency to run to seed in the early spring instead of making heads.

The engraving on the following page shows the Cabbage garden, photographed March 28th 1893.



SOWING THE SEED.

The manner of sowing the seed differed but little from that reccomended in Bulletin No. 15. The soil for the seed bed was made of rather light, moderately rich and well pulverized soil. After the bed had been prepared for sowing a rod was laid crosswise and then pressed down, being drawn backward and forward, so as to form a shallow groove. These grooves were made about 6 inches apart. In these grooves the seed was sown, and covered thinly with fine soil, then finisned by beating the surface or the soil gently with the back of a spade.

VARIETIES.

The following is a list of varieties grown: Newark Early Flat Dutch, Henderson's Early Summer, Early Etampes, Early Summer (Dep't of Agriculture) Early Winningstadt, Early Jersey Wakefield, and Early Summer Succession. All varieties were planted on the 9th of Oct., 1892. Very bright sun-shine followed for two weeks, which caused the plants to flag, but as soon as rain began all plants revived, and commenced to grow rapidly. By the middle of November all varieties were looking well. Those making the best growth, through December and January, were Early Etampes, and Newark Early Flat Dutch.

Early Winningstadt produced rather long stems. Those making dwarf growth, were Henderson's Early Summer, Early Jersey Wakefield, and Early Summer.

The last week in December and first week in January, these plants were covered with 10 in. of snow, after the snow melted away they looked quite healthy. On the last week of January and the first week in February, the plants were again covered with 14 in. of snow for eleven days, at the end of this time, when the snow disappeared, the plants still retained a very healthy appearance. Through March and April, they made but slow growth; but in the early part of May, they began to grow rapidly.

The following tabulated statement will prove of interest.

Name of Variety.	Per cent of plant going to seed.	Date of marketable maturity.
Early Summer	.00	July 2d
" Succession	.00	July 8th
" Jersey Wakefield	.02	June 4th
" Winningstadt	.02	June 18th
" Summer Dept. of Agr'l	.10	June 30th
Extra Early Etampes	.00	May 27th
Henderson's Early Summer	.14	June 28th
Newark Flat Dutch	.09	June 23th

CABBAGE. (SPRING SOWN.)

The following varieties, were grown from seed sent to the station, by different seedsmen for the purpose of testing them, the seed being sown in spring, in open ground.

World Beater—Burpee & Co.,—This is an excellent variety, producing good sized heads, averaging 10 in. in diameter; extra solid; and even in size.

Safe Crop—Burpee & Co.,—A variety resembling ("World Beater") to a great extent, producing good heads 10 in. in diameter.

Early Summer—Dep't of Agriculture.—Large heads, somewhat flat; 14 in. in diameter; solid; a good keeping variety.

Mammoth Rock Red—Possen & Co.,—Heads large and solid; used only for pickling purposes; quality, good.

Late Flat Dutch—Possen & Son.—Short stem, large heads: mature quick, and is of good quality.

Savoy—Possen & Co.,—This is strictly an early winter variety, as light frost improves its quality. for cooking purposes, making it more tender. It will stand more frost, than any other variety.

Burpee's Safe Crop.—Burpee.—Heads averaging 10½ in. in diameter; stem short; of very compact growth; heads firm, even and flat. Averages well with any of the other varieties, also has some advantages which others have not; having but few outside leaves, and stand a long time before bursting.

CULTIVATION OF CELERY.

The seed was sown on March 28th in pans, and placed in the forcing house. As soon as the young plants had made three leaves, they were pricked out into flats or boxes which were 3 in. deep and 12 in. wide. The plants were still kept in the house for four weeks. After this time they were placed in a cool frame to harden for two weeks. A bed was then especially prepared, in the following manner: a compost was made of rotten manure, and leaf mold, and about a fourth of rich loam, well pulverized and mixed together before being used. This compost was placed on very firm ground, to the depth of six inches and well trodden down, and afterwards well watered. As soon as the water had soaked away, so that the compost was not too wet for working, the plants were transferred. The plants were placed 4 in. apart, in rows 6 in. apart. Care was taken to keep the roots moist while out of the earth, and the long tap roots were shortened. The plants were given a liberal supply of water at all times. As soon as they had grown sufficiently to plant in their permanent position, the ground, which had previously been spaded 15 in. deep was put in readiness. This was done in order that the soil, should be well loosened, so that the water applied to the plants, should be permitted to drain through the soil more freely, thus preventing it from becoming stagnant and injuring the plants.

MODE OF PLANTING THE DIFFERENT ROWS.

Row No. 1 and 2—This was done by first digging out trenches or ditches 10 in. deep, then placing in it 3 in. of well rotted stable manure, mixed with hard wood ashes, 1 part ashes, to 5 parts of manure. This was put into the bottom of the ditch. This compost in the ditch was then spaded to the depth of 5 inches, thus mixing the 8 in. of compost with 2 in. of soil. This being completed, the plants were set out 12 in. apart, in a single row. The ditches were 4 feet apart, thus affording plenty of room, for earthing up. Each row contained 50 plants.

Row No. 3— was given a top dressing of loam, ashes and manure, in equal parts, without any apparent results.

Row No. 4— The trench was dug out 13 in. deep, and 6 in. of fresh cow manure, well spaded into the soil, at the bottom of trench. Much


Garden Queen
Grand Rental
8 lbs
Carter's Sale
Ivory
White Plume

better heads were obtained by this treatment, the plants made a much more rapid growth, and were of better quality.

During the dry season, plenty of water was given, never permitting the plants to become dry. Under this treatment, a good growth was kept up during the season.

Golden Yellow.----This variety was the first to mature, is good in quality, a few plants rotted during the season, is valuable for early use as it bleaches very quickly after banking up.

White Plume.----Heads small, requires but little banking up. Matured a few days later than Golden Yellow, the quality is not so good as some others. Its whiteness makes it easy of culture and it is becoming quite popular for early use.

Solid Ivory--This is an excellent variety. Stands winter well without rotting, has a good nutty flavor, is free from stringiness. Heads quite large, valuable for late use.

Grant Pascal—Resembles the solid Ivory in flavor and texture; head does not grow so large as the former, but make a very solid compact growth, as the season advances becomes quite pithy.

The accompanying cut on page 55 represent each variety.

TOMATOES.

The testing of different varieties of tomato was not carried on very extensively. Tests were made of varieties, sent to the station, by the following named seedsmen: J. M. Thorburn & Co; W. Atlee Burpee & Co; D. M. Ferry, and Posson & Son, agents Portland. As many of the varieties received, have been previously tested, it is not necessary to make further report of them. No variety has done so well, this season, as in seasons previous, owing to the late spring which caused the plants to make very slow growth. The last two weeks in May, they made very rapid growth but were soon overtaken by dry weather, by which they were again much retarded so that the fruit, on most of the varieties, was late in setting. The early fall weather, was very cool, with heavy frosts, consequently the plants were cut off before the fruit had fully matured.

Varieties which proved themselves this season, to be of value, were Atlantic Prize, Thorburn's Terra Cotta, Lemon Blush, and Matchless, which fruited in the following order.

Atlantic Prize (D. M. Ferry) Fruit above the average size; productive; first fruit matured on Aug. 21st; marketable maturity on the 30th; very valuable for early use.

Thorburn's *Terra Cotta;* fruit large, slightly angular or ribbed, and of good quality; a second early. The plant making a sturdy growth.

Lemon Blush—This is quite a good variety of the yellow-type; but not so productive as Terra Cotta, it is a second early, and a valuable addition to the list.

While others rotted very badly, no sign of rot was traced, on either of the three varieties mentioned. Tucker's Favorite, (Burpee & Co.) fruit large, failed to mature.

Early Michigan thirty days later than Atlantic Prize Dwarf Champion, a second early, fruit medium in size, quite smooth; solid and productive.

MISCELLANEOUS VEGETABLES.

Fordhook Squash:—This is a new variety, introduced by W. Atlee Burpee & Co. It has all the points claimed for it by this firm. It is a good winter variety; good keeper, has thin skin; very thick meated; very sweet; matures early and is one of the best for table use in winter.

Burpee's Columbia Beet.—An extra colored beet of good size and quality; even in growth, producing but few side roots; color, a deep blood red throughout.

Burpee's Improved Beet.—A variety producing but small top; matures early, and of good quality.

Burpees Iceland Lettuce.—Producing solid heads, 8 in. diameter, very crisp and sweet; is a valuable variety for main crop as it does not run to seed readily; it is in season for a long time.

VARIETIES OF KALE, OR BORECOLE (*Brassica oleracea Fimbricata*)

Kale produces large loose leaves and is of the cabbage family. It is very valuable for winter use, after cold weather has destroyed the cabbage crop, the Kale being hardier, produces an abundance of green vegetable all through the winter and spring. It fills up a gap that no other vegetable does by producing in late winter and through the spring.

Green vegetables of any description are always eagerly sought for in late winter and early spring. The action of frost, improves the flavor, but dry freezing winds will destroy the plants much more than frosts. Some varieties stand the freezing and thawing better than others. Like all varieties of similar description they require rich land. The soil should be spaded or plowed deep, and well manured.

CULTIVATION.

The seeds should be sown in nursery beds, early in April, and the plants set out not later than the middle of June, and treated in every respect, the same as cabbage. When taking the greens for use, the tops of the plant only should be taken, at about the third or fourth leaf on the stem. In about three weeks after the tops have been removed, the young shoots on the main stem will be fit for use. Below will be found a description of varieties, as grown on our trial grounds, this season.

Seeds of each was purchased from D. Landreth & Son Philadelphia.

Norfolk.—A dwarf close growing variety; leaves much curled, resembling parsley in the distance; height 6 in.; across heads 21. in.; is somewhat tender; is easily cut by frost, especially if the least damp.

Tall Scotch Curled:—This is a very hardy variety; good for general use; not so much curled as the foregoing variety, but stands the winter well.

Siberian.—Extra dwarf, dark green, tinged with purple, stooling out into several heads close to the ground; height 16 inches.

New Orleans Broad Leaf.—Plant has the habit of the Siberian Kale with the exception that the leaves are broader, color dark green; not much curled, resembles the rape plant in habit.


DWARF GERMAN PURPLE
SIBERIAN (CURLED)
TALL SCOTCH KALE
DWARF SCOTCH
EXTRA CURLED
RUSSIAN KALE
NORFOLK KALE
MOUNTAIN BRANCHING
EXTRA DWARF CURLED
BENNETT BROS

Bloomsdale.—Resembles the Norfolk in appearance, is not so dwarfed in habit; height 10 in.; extra good for table use.

Dwarf Scotch Curled.—Quite feathery; very handsome and hardy, one of the best for general purposes; height 16 inches.

Dwarf German.—This has the habit of the Siberian and New Orleans, only being of a much more purplish color.

Extra Curled Dwarf German.—The leaves are somewhat inclined to turn in; is valuable for winter use, plants stocky, branching out close to the surface of the soil.

Rosette.—In habit of growth resembles the German Kale in every respect.

The cut on preceding page represents the nine varieties described above.

COMPARATIVE TRIAL OF BEANS.

During the last three years, trials have been made with the several varieties of Lima beans; but we have not been successful at any time, in bringing them to maturity. The plants have made a strong growth at all times, and produce an abundance of bloom and a good set of pods have been made; yet in spite of all these good points, the plants have failed to mature their seed, in any one of the three seasons. All varieties grown this year, were not more than half matured, owing to the cool nights. Our season is too short. The plants do not make rapid growth early enough in spring, to enable them to mature their seed before the frost overtake them. Therefore the Lima is not a success in this locality.

NOTES ON BEANS.

Golden Max Bean.—Oregon Seed Co.—This proved valuable, as a late sown variety, sown on well pulverized soil, July 15th, matured Sept. 15th, without rain or irrigation, last picking on Oct. 15th.

Bush Lima—Burpee & Co.—Seed germinated well; plants made a vigorous growth; was well set with bloom; pods set well; failed to mature.

Willow Leaf—Burpee & Co.—A pole bean of medium growth; vine produces well; but did not mature its seed.

Early Black Lima—Burpee & Co.—Pole bean, of strong growth; failed to mature its seed.

Dwarf Black Wax—Posson & Son—Plants 12 in. high, of medium strength, rather small leaves; pods 4 to 5 in. long; yellow, of fair quality.

Early Golden Cluster.—Posson & Son—Pole bean; medium to tall; large leaves, bearing white flowers; pods 8 to 10 in. long from ½ to ¾ of an inch wide; very handsome and prolific, producing until cut by frost.

Extra Refugee—Posson & Son—Vines twenty inches high, somewhat branching; leaves medium in size; pods, large; and of fair quality; productive.

Sun Rise Wax, Pole—Burpee & Co.—A strong growing variety; pods large, somewhat flat and of excellent quality.

Keswick's Codlin Apple.—Medium to large; conical and ribbed; greenish yellow, changing to quite yellow; stem from ½ to ¾ inches; cavity varies in depth; calyx large; juicy with a pleasant acid flavor; good quality for cooking; an early bearer; very hardy and productive; in season from the middle of Aug. until the last of Dec. It is not a table apple but is very valuable for cooking in its green state, as well as when matured, requires careful handling. Is an excellent variety to plant in the orchard, with other varieties, as it is a great pollen producer.

Prunus Simoni.—The Simon Plum has been growing for several seasons, but on account of its early blooming has been cut by late frost. This last season the trees were protected from the heaviest frost, by spreading a light canvas over them, duriug the night. By this means, quite a a number of the plums were saved and came to maturity. The fruit is very attractive to the eyes being of a dark red, mottled with the lighter shades. The stem is short; large suture; flesh yellow; very firm; clings well to the stone, good keeping qualities; having kept it in perfect condition for 30 days. The longer it is kept, the darker the color of the fruit becomes. The flavor is unpleasant to the taste, being very bitter, quite equal to quinine. It is not improved by cooking. The tree makes a very compact growth, is very hardy; commences to bloom quite young. In appearance it is a fine fruit, but very deceptive.

Amelauchier Canadensis—Dwarf Juneberry, or service berry.—This bush resembles the variety found wild; it needs no farther description. Only by a high state of cultivation has the fruit been much improved in color and size, as well as flavor. The fruit is liable to attacks of fungus (*Roestelia lacerata* Fr. ?); size of fruit about as large as the medium sized peas; ripening the last week in June, and the first week in July. It has a mild pleasant flavor; bushes dwarf, at present only two feet high.

White Black Currant—Bush makes a strong growth, resembling the black Naples, in every respect, excepting that the fruit is of a dull gray color; large and productive; when cooked it is a much paler color than any of the other varieties of the Black currant.

Gooseberry; *Powell's Seedling*—This is a chance seedling, found in the garden of J. S. S. Powell, Philomath, Oregon. This is the first season of fruiting. Fruit in circumference 2⅝ in.; length 2⅞ in.; roundish approaching oblong, slightly downy; skin thin; flavor good; color pale green; medium growth; with few spines; form erect.

Child's Golden Queen Raspberry.—Canes of medium growth. Its tendency is to throw up a great many suckers; berries medium in size; firm and sweet; color light yellow; moderately productive; valuable for immediate table use and for mixing with other varieties for contrast of color, also good for making a light colored jelly, matures early.

Child's All Summer Raspberry.—Plants strong; fruit large; moderately firm and acid; color dark red; very promising.

Crimson Raspberry.—Canes medium in growth and close jointed; fruit

large and soft. The first fruits to ripen are quite acid, but later in season improves in flavor being much milder. Name indicates color.

Wilson Junior Blackberry.—Canes have made a weak growth; this is perhaps caused from the location, it being too dry for them. Fruit large; rather soft, too much so for a distant market, good quality. A further trial will be made.

Downing Mulberry.—Tree a strong grower; making as much as six to seven feet in one season; produces from the end of June, until cut by frost.

NOTES ON VARIETIES OF GRAPE.

Green Mountain.—Vine a vigorous grower; very productive; fruit of excelent quality; early; a grand acquisition to the list; is free from disease. It has been grown here four years. Can be highly recommended for this locality.

August Giant.—Resembles Black Hamburg in color; berries inclined to be oblong, rich; makes a very strong growth. Ripened the first week in September.

Faith.—A vigorous grower; berries medium white with a tinge of yellow; good quality. Ripened the 2nd week in October.

Pocklington.—Vine made a medium growth, clusters of medium size. Berries large, pale green tinged with yellow. Matured October 29th.

Warden.—In general make up, and appearance is very much like Concord, (a purplish black); bunches rather large; berries a little above the average. The vine made a good average growth; matured Sept. 27th.

Wilber.—Vine makes a vigorous growth, bunches large; berry round; color very dark purple; juicy and rich, with a slight flavor of the Muscat. Ripening the 1st week in October.

Goethe.—Vine a very strong grower, producing stout long canes, bunches large and of good form, but did not mature its fruit.

Delaware.—Vine not a strong grower, an early bearer, producing small compact bunches, berries, small round and light red, also sweet, an excellent quality, matured its fruit Sept. 22nd.

PEACHES.

S. 9. French.—Fruit medium to large slightly enlarged on one side, deep suture half round; whitish green in shade; marbled; deepening into dark purple; crimson in sun; flesh greenish white, very sweet and juicy; cling; resembles Waterloo very much. Bloomed April 9th, matured Aug. 9th

Alexander.—Tree after blooming, died down to the ground below the graft. Have been badly affected with curl leaf, in previous years. The wood was not well matured, consequently was very easily affected by the hard freezing. Bloomed April 9th.

Hardy Tuscany.—The tree itself is very hardy, seldom affected by curl leaf, and very thrifty. It has failed to produce fruit as yet on account of late frost in spring. Bloomed April 22nd.

Columbia.—Tree very hardy, has made a vigorous growth; is not affected by curl leaf, and has not fruited. Age of tree five years. Bloomed April 24th.

Honest Abe.—This variety has been very much affected by curl leaf; two trees having died out from its effects. The remaining tree is not thrifty. Too tender for this location. Bloomed April 11th.

Reeves Favorite—This variety has not proved in any way suitable to this location, being badly affected by curl leaf, and dying back every spring until the trees have nearly died out.

Elison—Has made a moderate growth; although it has been somewhat affected by curl leaf. The tree matures its wood well. So far has had the bloom cut off by late frost; consequently, has not as yet produced any fruit. Bloomed April 16th.

Burnice—This variety died from the effects of curl-leaf in 1892.

Perkins—A very hardy and thrifty growing variety; so far has been free from curl leaf, but owing to late frost it has not produced fruit. Bloomed April, 23.

Hales Early—Tree, much too tender for this location, has been killed down to ground line, from the effects of frost.

Miller's Seedling—Very weak growing variety, wood very healthy, not much affected by curl leaf.

Austin Cling—A very free growing tree, seldom attacked by curl leaf.

Comet—Tree a vigorous grower, matures its wood well, and is not affected by curl leaf. Bloomed April 17.

Pallas—This variety has been badly affected by curl leaf in former years. This season the trees made good growth. Bloomed April 23.

McKivett Cling—Trees perfectly healthy, produced but few blooms; was affected by late frost. Bloomed April 16.

Alpha Cling—Tree vigorous grower, has produced but few blooms; one of the varieties that have been free from leaf blight. Bloomed Ap'l 23.

Oriole—Has proved too tender even to make good wood growth. Two trees have already died, and the third is not looking well.

Boston.—Has made but little growth in any year since planted out.

Bishops Early.—Tree makes a healthy and vigorous growth, matures wood well. Bloomed April 20th.

Miss Lola.—This variety has been affected so badly by curl leaf, that two trees have died from the effects. The tree remaining is gaining in strength. Bloomed April 20th.

Indian Blood.—Tree has made weak growth, from the time of planting. Is not affected by curl leaf, so much as some other varieties.

Wheatland.—Has proved to be quite worthless here.

Ulatis.—Tree has proved to be quite hardy, with but little curl leaf; Fruit medium size greenish-white in shade; deep red in sun, mixed with purplish red; flesh firm, juicy and sweet, melting, cling. Bloomed April 12th, matured Aug. 10th.

Tuscany Cling.—Of no value; too tender for this locality.

Sellers.—Tree of no value, altogether too tender for this locality.

Mays Choice—Has not produced fruit, as yet, tree a vigorous grower.

Clements.--Tree very healthy; not affected by curl leaf. Bloomed April 12th.

Elberta.—Tree is very tender, is not suited for this location.

Fishers Late.--So far, this variety has proved to be of no value whatever.

Alexander.—This variety is grafted on the Myrobalan plum, which has a tendency to dwarf the tree. Has made a sturdy growth; very healthy; wood ripening well. No signs of curl leaf. Fruit of good size; round, with a deep suture, skin covered with rough down; pale with a few red spots on the side next the sun; flesh tender and of good quality. Bloomed April 11th. Matured Aug. 12th.

STRAWBERRIES.

Anna Forester—Plant makes a sturdy growth; foliage light green; berry round to conical, slightly ribbed, good quality, soft; productive; an excellent exhibition variety. Age of plant, 2 years

Alabama.—Perfect. Not a strong growing plant. Shy in setting its fruit. Medium size; form, round to conical, not productive. Age 2 years.

Crawford.—Perfect. Plant of medium growth, foliage dark green, berry large; conical to flat; color red; flesh light red; rather soft; flavor good. Age of plant 2 years.

Captain Jack—Perfect. Not a strong grower; producing but few runners, fruit conical. Not of good quality. Not productive. Age 2 years.

Chambers—Berry soft; color light red; medium in size, affected with mildew and rust, not of much value here. Age 2 years.

Crystal City—Plant makes a strong growth, but very shy in setting; its fruit has not proved to be of value. Age 2 years.

Crescent—Imperfect. A strong grower; foliage dark green. Color of fruit bright red of medium size, conical, soft and insipid; productive. Age 2 years.

Enhance—Perfect. Plant of strong growth: fruit light red; borne on long fruit stalk, large, conical, slightly ribbed, soft, medium in flavor; resembling Anna Forester very much. Midseason, too late. Age 2 years.

Wilson--Plant of medium growth; fruit conical; midseason, productive; standard market berry here. Age of plant 2 years.

Triumph de Grand—Perfect. Plant makes a vigorous growth; berry large, crimson, flesh rather soft, good flavor; cockscomb in shape. Useful for home and near market. Plants of this variety were supplied by Salem Nursery Co. Salem, Oregon. Age of plant, 2 years.

Gypsy—Imperfect. Plants make a very dwarf and compact growth; foliage, dark green; fruit conical to round, color bright red, good quality; a little soft, productive Plant aged two years.

Lady Jane--Perfect. Plant, a vigorous grower; fruit, bright red and evenly colored; solid, round, of a sharp flavor, quite productive.

Sadie—Imperfect. A dwarf growing variety, foliage dark green, fruit small; good flavor, soft, color pink; productive; requires to be grown with good pollen producing variety to bring it to perfection.

Eureka—Imperfect. Plant close growing; is not a desirable variety.

Stayman—Perfect. Plant in growth, resembles Cumberland, midseason; fruit, long, conical, color dark crimson, not productive.

Greenville.—Imperfect, Habit of plant above the medium growth, fruit inclined to be a little soft, only moderately productive.

Smeltzer's Seedling.—Perfect. This is an early variety, ripening with Michael's Early, and May King.

Boon.—Berry conical, some pertaining to Cockscomb in shape, large, good quality, firm, midseason, not productive. Plant of moderate growth.

Jewel.—Resembles the Wilson, in growth of plants; fruit is not so acid, medium in size, Productive.

Perry.—Imperfect. Plant of medium growth; berry good in form, firm, large, excellent flavor; round to conical, produced on long stalks.

West Lawn.—Imperfect. Foliage large, only moderately productive, fruit irregular,conical in shape, color, bright red, plant a strong grower; an early variety, berry, firm; of a sprightly flavor. Age of plant 2 years.

Edgar Queen.—Perfect. Plant medium in growth, fruit of medium size, soft and insipid, has not proved to be of any value here. Age of plant 2 years.

Lady Rusk.—Perfect. Above the average in growth of plant; foliage, light green; color of fruit, light red; slightly ribbed, some berries cockscomb in shape; good flavor; productive. Age of plant 2 years.

Parker Earle.—Perfect. Plant makes but few runners, foliage dark green; of medium growth; fruit above the average size; conical, excellent quality; good for both market and home use. Age of plant 2 years.

Shuster Gem—Perfect. Plant a strong grower; berry large, dark red; conical to flat; good flavor but very soft. Age of plant two years.

Tippecanoe.—Imperfect. Plant made a strong growth but failed entirely to fruit so far. Age of plant two years.

Collier—J. C. Bauer, Kansas. Perfect. Foliage dark green; fruit solid; cockscomb in shape; dark red; borne on long pedestals. Has proved so far only moderately productive. Age of plant two years.

Barton's Eclipse.—J. C. Bauer, Kansas. Imperfect. Plant a vigorous grower, foliage dark green, fruit very large; conical, soft, and of excellent flavor, season late. Age of plant two years.

Beder Wood—J. C. Bauer, Kansas, Perfect. Foliage dark green, fruit bright scarlet, of medium size, flesh pink, only moderate in firmness; season early. Age of plant 2 years.

Great Pacific—J. C. Bauer, Kansas. Imperfect. This variety is an extra strong grower; berries conical and large; dark red in sun, changing to light red where shaded. Does not ripen evenly, being quite unripe at apex sometime after other portions of the berry have matured Very large and productive. Age of plant two years.

Charles Downing—Perfect. Plant vigorous, fruit medium in size; color dark red; flesh firm; good quality. Productive.

Felton—J. C. Bauer, Kansas. Perfect. Plant a compact grower; foliage dark green, fruit large, conical; flavor good, dark red; solid; productive; midseason. Age of plant 2 years.

Banquet—Perfect. Foliage light green of medium growth; berry, conical, color red, good quality, shy producer. The plants do not stand the damp winters well, is late in commencing to grow in the spring. The blooms are very weak. To make a successful test plant, will have to be planted in different soil and locality.

Bidwell—Perfect. Plant a strong grower; berry conical, color crimson, flesh firm, flavor good, slightly sub-acid; only a moderate producer, second early. Age of plant 3 years.

Gen. Putnam—Perfect. This variety resembles the Bidwell in every respect.

Standard.—Perfect. Plant has made but medium growth; fruit large, excellent flavor, but flesh rather soft.

Swindle.—Imperfect. A compact growing plant, foliage dark green; berry dark red, of good quality. Need further trial.

E. P. Roe.—Perfect. Has failed to produce, plants made but a very weak growth.

Southard.—Made but a very weak growth, has produced but little fruit. Medium in size. Color bright scarlet, long conical. Plants have made a very poor growth, but the fruit that has been produced is of good quality.

Jucunda Improved.—Perfect. Plant of medium growth; berry conical, color scarlet, flesh pale salmon, firm, of fair quality, a little soft, productive, good for near market. Midseason, too late. Age of plant 3 years.

Beverly.—Perfect. Plants made good growth; foliage dark green; failed to produce fruit.

Leader.—Perfect. Has done no good here, so far.

Dayton.----Perfect. Failed to produce; plants have done badly, not a promising variety.

Yale.----Perfect. Plant of robust habit, foliage of light green, berry large, conical, very dark red; good quality.

Dew.----Plants make a strong growth; foliage dark green; berry large, has not been productive as yet.

Early Idaho.----Plant a strong grower, fruit dark red, of good quality; not productive.

Myatts British Queen.----Perfect. Plants were imported. This is a standard variety in England, but is of no value here. Berries rounded to cockscomb; what fruit matured was of excellent quality and firm, midseason, too late.

Mrs. Cleveland.----Imperfect. Plant above the average strength. Produces runners freely, fruit medium size, color light red, conical to cockscomb in shape, moderately productive, foliage light green, too soft for shipment long distances.

The following varieties will be given further test, namely: Dew, Collier, Smeltzer's seedling, Boon, Jewel, Edgar Queen, Shuster Jem, West Lawn, Felton, Gen. Putnam, Standard, Early Idaho, Swindle, E.P. Roe, Beverly, Leader, Dayton.



The above cut represents a Prune tree five years old before pruning.



The above cut represents the same Prune tree after pruning.

NOTES ON PRUNING THE PLUM & PRUNE.

The cultivation of the prune, is now quite extensively practiced throughout the state of Oregon. A few remarks on the manner of pruning, may be of benefit.

In pruning back young trees, that are one year of age from the bud, care should be taken to see that the buds cut back to, are perfect, especially if the trees have been transported any distance. In such cases, the trees on the outside of the bundles often have their buds rubed off in handling. If the pruner is not very careful, he may not notice this. It often happens, when it is cut back to a damaged bud, that the stem dies back to

a perfect bud, or that the latent buds are forced into growth. When this is the case, the young shoots make but a weak growth. It is better to head off a trifle lower or higher, as the case may be, so that the trees may be cut back to a perfect bud. This will insure a much stronger growth. Three shoots will be all that is needed, the first year. At the next winter pruning, these may be cut back about one half. From each of these three shoots, two other shoots should be encouraged to grow the following summer. It should be borne in mind that we should always prune back to a bud pointing most in the direction needed for filling up space, and to regulate the distance from limb to limb. At the second pruning there will be six branches. These may be cut back about half of their growth, and from these two other young shoots should again be encouraged during the summer. This will produce twelve main branches, which will be sufficient to form the head of the tree.

During this time, the first year's growth, will have formed fruiting spurs which will produce a small amount of fruit the third year. There will also be lateral shoots formed, as well as fruit spurs. These laterals should be pruned back to two or three buds, and on the portions left, fruit buds will form. If this principle of pruning is carried out, the main branches of the tree will be well supplied with fruit spurs, the entire length.

The tree may be kept headed down to any required height that the grower may desire. Do not head off quite level, but give the trees a symmetrical form. When cut back level the young shoots become to much matted, thus preventing a free circulation of air. After a few years, it will be found that the fruit spurs have become too long, when this is the case they may be pruned back by degrees, and other spurs will be formed. It will be found that the main branches will gain strength each year, and be enabled to cary a great amount of fruit without breaking.

The system of cutting back severely for two or three years, produces strong growth, and instead of producing fruit spurs, wood buds are formed. The head of the tree, should have its branches trained far enough apart, to afford plenty of light and free circulation of air.

Disbudding—This is an operation, which is not given that attention which it should have. It consists in rubbing out with the thumb and finger, young shoots that are not needed, as soon as they have pushed out far enough to be taken hold of, thus doing away with a great deal of young wood. This concentrates the strength to the rest of the tree, during the growing season; and, on the other hand, it does away with much of the winter pruning.

WEBFOOT FERTILIZER.

In the spring of 1892, we received from F. L. Posson & Son, Portland, Or., a quantity of Webfoot fertilizer for trial. Tests was made on the following varieties of fruit and vegetables. Strawberries were increased both in foliage and fruit 75 per cent. Applied to peas, the growth was increased 50 per cent., advancing the maturity seven days. The effect on corn was the same as on peas. It was used on turnips, tomatoes, and applied as a top dressing to pot plants with excellent results.

May 11, 1894

Oregon Agricultural Experiment Station

Bulletin No. 30. March, 1894.

AGRICULTURE.



1.--Potatoes.

2.--Roots.

H. T. FRENCH,
Agriculturist.

C. D. THOMPSON,
Foreman of Farm.

The Bulletins of this Station are sent free to all residents of Oregon who request them.

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POTATOES.

H. T. French.

One hundred and fifty three varieties of potatoes were grown last season on the Experiment Station farm. Eighty-eight were grown in plats large enough to warrant a calculation of yield per acre. The remainder were grown in small amounts, to determine their manner of growth, as effected by our soil and climate.

The potatoes were grown on a clover sod which was plowed in the winter, and again in the spring just before planting. No fertilizer was used, except a dressing of wood ashes sowed on the field after planting.

The potatoes were cultivated with a Planet Junior, one horse cultivator, thus keeping the ground as level as possible. While the season was unfavorable for the potato crop, owing to the cold, dry weather, the yield was farely good, and the quality of the tubers was very good.

There was very little fungus growth, or dry rot, on the potatoes last season.

A thousand, one pound packages of potatoes were sent out to the farmers of the State last season for trial, and, in several cases, the results were unsatisfactory because of the fact, that fresh manure was plowed into the ground in spring just before planting. Manure applied in this way makes the best condition possible, for the development of fungus diseases. There is not moisture enough in the ground, to cause complete decomposition of the manure, and it serves as a most excellent culture medium for the germs of fungus diseases. Manure should be plowed under in the fall, so that it may become thoroughly incorporated with the soil, before the time of planting.

The mechanical effect of stable manures when applied in the spring, in making the soil too open and loose, is also detrimental to the growth of the potato plant.

Of the varieties, which seem to warrant recommendation after two years trial, we would mention the following.

Dublin Chief.—Smooth, white potato, with fine shallow eyes; round and slightly elongated in shape.

James Vick.—Large, flattened potato; russet skin, redish tint, with fine shallow eyes.

Burling.—Round potato, slightly flattened; smooth, reddish skin, and few deep eyes.

White Lion.—Long, white, smooth potato; eyes shallow and few in number.

Thorburn's Late Rose.—This is a late potato which resembles the Early Rose very much. It grows to a large size, moderately smooth, eyes small rather deep; russet skin which is a rose color. For a late potato, to take the place of the Early Rose for shipping purposes, this potato should meet with much favor.

Dakota Red.—Although a rough, red potato, it is one of the best keepers, and is fine for table use late in the season. There are none in the list more hardy in their growth than this one.

Tilden.— This is also a rough potato, but a good yielder and an excellent keeper; skin pinkish in color, flesh white.

Early Sunrise.—Of the early varieties this potato seems to be the most desirable, although the yield was not very large this season, owing to the extreme dry weather. It is a smoother potato than the Early Rose, and is earlier in ripening. The skin is not so dark, as that of the E. Rose, and the flesh is free from any pink coloring, which so often affects the E. Rose. When once thoroughly introduced, this potato we believe, will give general satisfaction.

Rochester Favorite.—This variety could easily be mistaken for the Burbank, except it is a little smoother in outline, and has a russety skin when fully mature. It ripens earlier than the Burbank. In yield, it does not quite come up to some of the coarser varieties; but it is of uniform size which will partly compensate for the lack in yield.

Silver Skin.—For an early potato this is one of the most desirable. As its name indicates, it is white in color, and it is a very smooth potato. It is one of the most attractive potatoes on account of its smooth, white skin. It is equally desirable in quality when cooked. In yield, it is not quite up to some of the other varieties.

Of the varieties which were grown last season for the first

time, on sufficient area to test the yield, the following are mentioned as presenting very desirable qualities.

Coy's Seedling, No. 88.—This variety has been grown in some of the Eastern States, with a great deal of success. It is a white potato, very smooth, eyes shallow, flesh white, and a good keeper. The yield was nearly equal to the largest in the list.

Salt Lake Rose.—This variety made the largest yield of any in the list. It is a medium sized, rose colored potato; rather rough skin, long and flat in shape; eyes shallow. It will be given a further test before being recommended.

Van Orman's Superb.—We had one potato of this variety, sent to us for trial by the man after whom the potato is named. Twenty pounds of very nice tubers were grown from the potato received. It is a white potato, oblong in shape, smooth outline, shallow eyes, and slightly roughened skin. From all appearances, it will make a valuable aquisition to the list of desirable varieties.

List of Potatoes grown in small plats.

Van Orman's Superb.	Jewett.	Galva.
White Grange.	Royal.	Telegraph.
Glasgow.	Java.	Medley.
Watson's Seedlings.	Prince Albert.	Legal Tender.
Blue Victor.	Spartan.	Veteran.
Royal No. 10.	Big Benefit.	Blue May Flower.
Prairie Flower.	Puritan.	Sweet.
Harvest Home.	Amsterdam.	Interior.
Planet.	Highlander.	President.
Captain.	Trotter.	Pearl of Savoy.
Hollander.	Little Giant.	Gipsy.
Duchess.	Triumph.	Crown Jewel.
Burbank.	Red Lion.	Irish Cup.
Cherokee.	Early English.	Irish Red.
White Magic.	Lap Wing.	Drew.
Phœnix.	Altamont.	Gleason.
Arizona.	Great Britain.	White Peach blow
Paris Rose.	Matchless.	Zoar
Late Ohio.	Columbian.	Yarrow.
Early Mayflower.	Hemlock.	Yucatan.
Chili Pinkeye.	Mexican Merino.	Wipple's Pinkeye.
Old Michigan Red.	Farmer's Delight.	

The following tables give the names and yield, of varieties tested.

NAME OF VARIETY.	No	Date of Planting.	Date of Harvesting.	Early Medi'm Late.	Yield per acre in Bushels.
Salt Lake Rose	1	May 25	Oct. 14	M	279⅓
Coy's Seedling No. 88	2	" 25	" 18	M	247⅙
Thorburn's Late Rose	3	" 25	" 14	L	215¼
Burling	4	" 25	" 14	L	213⅙
James Vick	5	" 25	" 14	L	201¾
Tilden	6	" 25	" 14	L	208
Dakota Red	7	" 25	" 18	L	234
Rural Blush	8	" 25	" 14	M	196⅓
Magnolia	9	" 25	" 18	M	211
Grange	10	" 25	" 18	M	189
Early Rose	11	" 25	" 14	E	197⅓
Wig Wag	12	" 25	" 18	L	193⅔
Vam	13	" 25	" 18	L	183¾
Peerless	14	" 24	" 18	L	153⅓
Kent	15	" 25	" 14	L	166
Mammoth Pearl	16	" 25	" 14	M	166
Brownell's Winner	17	" 25	" 14	L	155⅓
Dublin Chief	18	" 25	" 18	M	172⅙
Rochester	19	" 25	" 14	L	171⅙
State of Maine	20	" 24	" 14	E	136½
Sultan	21	" 24	" 14	M	84
Burpees' Superior	22	" 24	" 14	M	90⅓
Garfield	23	" 24	" 14	M	120⅔
Defiance	24	" 24	" 14	M	104
Princess	25	" 24	" 14	L	92⅓
Geo. III	26	" 24	" 14	L	85
Jones' Prize Taker	27	" 24	" 14	E	105
Silver Skin	28	" 24	" 14	E	114½
Pacific	29	" 24	" 14	M	123
O. K.	30	" 24	" 14	L	106
White Lion	31	" 24	" 14	M	139⅔
Rubicund	32	" 24	" 14	M	146
White Star	33	" 24	" 14	M	114½
Chas. Downing	34	" 24	" 14	M	107
Alexander's Prolific	35	" 24	" 14	M	120¾
Paragon	36	" 24	" 14	M	97⅔
Pride of Mason	37	" 24	" 14	M	99¾
Rural Buttercup	38	" 24	" 14	E	85½
Baker's Imperial	39	" 24	" 18	E	104½
Early Sunrise	40	" 24	" 14	E	105
Dakota Boss	41	" 24	" 14	M	108
Rural New Yorker, No. 2	42	" 24	" 18	M	123
White Cloud	43	" 25	" 14	M	134⅓
Atlantic	44	" 25	" 18	M	96
Gen. Stark	45	" 25	" 14	M	108⅙

NAME OF VARIETY.	No.	Date of Planting.	Date of Harvesting.	Early, Medi'm Late.	Yield per acre in Bushels.
Antwerp	46	May 25	Oct. 18	M	98⅔
Cal. Peach-blow	47	" 25	" 14	M	139⅔
E. Minnesota	48	" 25	" 18	E	57¾
White Elephant	49	" 25	" 18	M	61
Minn. Seedling	50	" 25	" 14	M	61
Belle	51	" 25	" 18	M	133
White Japan	52	" 25	" 18	E	114½
Harbinger	53	" 25	" 18	M	82
Hoag's Seedling	54	" 25	" 14	M	145
Hamden Beauty	55	" 25	" 18	E	107
Lewiston Seedling	56	" 25	" 14	L	94½
Suc. Planter	57	" 25	" 14	M	65¼
Wisconsin Blue	58	" 25	" 14	M	138½
Compton's Surprise	59	" 25	" 18	E	112
Favina	60	" 25	" 14	L	98⅔
White Wisconsin	61	" 25	" 19	L	110
Early Wisconsin	62	" 25	" 14	E	67⅙
Signal	63	" 25	" 19	E	74⅔
Peoples	64	" 25	" 14	E	105
Park Region	65	" 25	" 19	E	92⅓
Seedling No. 15	66	" 25	" 14	L	112½
Rose Seedling	67	" 25	" 14	M	105
Plymouth Rock	68	" 25	" 19	M	64
Freeman	69	" 25	" 14	M	105
Ideal	70	" 25	" 19	M	105
Monroe Co. Prize	71	" 25	" 18	M	100¾
White Rose	72	" 25	" 18	L	139¾
Garnet	73	" 25	" 18	L	135
Comforter	74	" 25	" 14	M	96½
Manhattan	75	" 25	" 18	L	147
Addison	76	" 25	" 14	M	90⅓
Badger State	77	" 25	" 18	L	123
Gen. Logan	78	" 25	" 14	L	139⅔
Capricorn	79	" 25	" 14	L	120¾
Thunderbolt	80	" 25	" 18	L	118⅔
O. K. Mammoth	81	" 25	" 18	L	140⅔
Champion	82	" 25	" 14	M	138½
Riley	83	" 25	" 19	L	166
Rochester Favorite	84	" 25	" 14	L	124
Parson's Prolific	85	" 25	" 18	L	94
Jumbo	86	" 25	" 14	L	140⅔
Starr Russett	87	" 25	" 18	L	130⅙
Garnet Chili	88	" 25	" 14	L	140⅔

Roots.--Mangel Wurzel.

Only four varieties of mangels were tested on the experimental grounds last season. These were selected from a list of eleven varieties, grown the preceding year, being those which seemed to warrant a further trial. There are always a few varieties, which will give much better results than others; and it has been our purpose, to select such as indicated superior qualities over the other sorts, and, after sufficient trial, to recommend these to the farmers of Oregon.

The roots were grown upon a heavy clay loam, fertilized by a dressing of barnyard manure applied during the winter and early spring. We have no loose bottom land, such as that found on many of the farms of Oregon. An open, rich soil is much better for root crops.

Our land was plowed early in the spring, and subsoiled to the depth of 18 to 20 inches, Roots will not grow smooth and straight, unless the subsoil is sufficiently loose for the tap root to easily penetrate it.

Mangels, carrots, and rutabagas, were grown under the same conditions.

Orange Globe Mangel.—This variety has been grown for three successive years, and has given the largest yield of any in the list. It is a good keeper, and is not as coarse grained as some of the long varieties, which grew with a large portion of the root out of the ground. The yield of this variety, was 10 tons and 4 cwt. per acre, in 1892; and 12 tons and 15 cwt. in 1893.

Giant Intermediate,—Is next in yield, and is a very desirable variety. It resembles the Tankard in its shape and manner of growth. This variety yielded 8 tons and 13 cwt. per acre, in 1892; and 11 tons and 9 cwt. in 1893.

Carter's Warden Orange Globe.—There is very little difference between this, and the Orange Globe, as far as habit of growth, and the appearance of the roots are concerned. It did not quite equal the latter in yield. It yielded 7 tons and 14 cwt. per acre, in 1892; and 9 tons and 18 cwt. in 1893.

Golden Tankard.—For good keeping qualities, and for an excellent mangel, so far as firmness of grain is concerned, there is none that will excel the Golden Tankard. It is one of the standard varieties for general cultivation. In shape, it is intermediate between the long yellow, and the globe varieties. It grows partly out of the ground, and is easily harvested. It carries very few fine roots when mature. The yield in 1892, was 7 tons and 14 cwt. per acre; and 9 tons and 5 cwt. in 1893.

Carrots.

Three varieties of carrots were sellected, from thirteen varieties grown in 1892; for a more extendid trial.

Mastodon.—There were none that equaled this variety in yield, in 1892; and in quality, it was not surpassed by any. It is a very smooth stocky root, and does not require as deeb a soil as some of the longer varieties. The flesh of the carrot is yellowish in color. This carrot is shown in cut No. 13. Yield in 1892, was 10 tons and 11 cwt. per acre; and 12 tons 8 cwt. in 1893.

Long White Green Top.—Of the deep rooting varieties, this one seems to do the best. There is very little if any difference, between this one and the White Belgian. It grows long and slender, requiring a deep loose soil. It is not so easily harvested as the Mastodon. Cut No. II shows a sample of this variety. Yield in 1893, 12 tons and 12 cwt. per acre.

Orange Belgian.—In 1893, this variety did very poorly; but we were led to give it another trial, from the high recommendations which it received from seed dealers. It is not as desirable, as either of the other varieties mentioned, in yield or quality. The roots were not as smooth, and it does not harvest as easily. It grows deeper in the ground. Yield in 1892, 4 tons and 14 cwt; and 9 tons and 2 cwt. in 1893. This is nearly 3½ tons less, than the yield of either of the other varieties. No 5 in cut.

Names of varieties of carrots shown in cuts. Plate I, No. 1 Danvers Half Long; 2 Long Red Coreless; 3 Scarlet Altringhome; 4 Red St. Valery; 5 Orange Belgian; 6 Improved Long Orange; 7 Nichols Improved. Plate II, No. 8 Yellow Belgian; 9 White Vosges; 10 White Belgian; 11 Long White Green Top; 12 Victoria; 13 Mastodon.

Rutabagas.

After growing several varieties of sweedes, the following are selected as having done the best.

Yellow Sweedish Rutabaga.—This is a yellow type, which differs but little from the purple top sweede. It does not have quite as high a crown, as the purple top, and is not quite as dark in color. It carries very few fine roots when mature, thus making it easier to handle, and much freer from earth, which



PLATE I.



8 9 10 11 12 13

PLATE II.

adheres to those varieties that have a mass of fine roots, clinging to them. It yielded 16 tons, and 15 cwt. per acre in 1893.

Champion Purple Top.—This does not differ from the Purple Top, which has been a standard variety for many years. It is a very desirable variety, in every way. It is yellow in color, with purple crown. Yield 16 tons, and 6 cwt. in 1893.

Improved Sweede.—This is another yellow variety, much like the varieties already discribed. It is not quite as dark in color, as the Purple Top. Yield 14 tons, and 4 cwt. in 1893.

Our ground is not well adapted to growing sweedes. It gets too dry during the summer. The roots nearly cease growing, and become stunted before the rains come in the fall. Plant lice injure the rutabagas very badly. The quicker growing varieties of turnips, will give better results I believe. These can be sown very late in the season, and make their growth in the fall after the rainy season begins.

May 11, 1894

OREGON AGRICULTURAL

Experiment Station.

Bulletin No. 31. - - April 1894.

Entomological Department.



ARTICLE I.--Progress of work: Codling Moth, Hop Louse, Flea Beetles, Radish Flies, Cut Worms and Wire-worms, Tent Caterpillars, Illustrations of Oregon Insects and Insect work, Gophers and Moles.



ARTICLE II.--Capons and Caponizing.

The Bulletins of this Station are sent free to all residents of Oregon who request them.

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1894.

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PROGRESS OF WORK.

F. L. Washburn.

The following is a brief report of work accomplished in this department during the year. Article I treats on work with various insects. Article II on Capons and Caponizing. The insects discussed are the Codling Moth, Hop Louse, Flea Beetles, Radish Flies, Cut-worms, Wire-worms, and Tent Caterpillars. There is also a short paragraph on Gophers and Moles. To Article I two plates are appended, one illustrating a few Oregon insects, the other, specimens of insect work. Article II is illustrated with two half tone plates and a number of line cuts.

While there has been no specially injurious outbreak of insects the past season, nevertheless Tent Caterpillars have been exceedingly numerous in at least three forms, and, in places quite destructive. *Clisiocampa erosa Strech.* and *C. plurialis* Dyar, have swarmed in some apple orchards, and have also fed generously on Plum and Prune, as well as on the foliage of Roses.

The third species of Tent Caterpillar, *C. constricta*, has in places, stripped the leaves from large areas of oak trees. It by no means follows, because these pests are troublesome for one or two seasons,that the same locality will be afflicted permanently. They may, after one or two years leave a place where they have been present in enormous numbers.

Large crickets, a species of *Anabrus*, have been numerous in wheat fields in Eastern Oregon. The Mediterranean Flour Moth, which has proved so troublesome in parts of Canada and the United States, may, at any time appear in flour mills in this state.

As the season of Spring approaches the irrepressible small boy appears on the scene with sling-shot and target rifle and begins the cruel work of murdering our familiar birds. Most of these birds are, in the long run, beneficial to the horticulturist and farmer. Moreover, for every bird slain a large number are only wounded and escape, to drag out a wretched existence until death relieves them. The thought of the unnecessary suffering, inflicted upon helpless animals by the thoughtless or cruel, prompts me to take this opportunity to appeal to citizens of our towns and cities, urging them to see that the laws which forbid the use of sling-shot or gun within the corporate limits, and the laws which protect our birds be rigidly enforced

In the following pages, all half tones and line cuts, except Fig 2, 3, 6, 9, 10, and moth on title page, have been made by Mr. Pernot, photographer to the station and college, and I wish here to acknowledge my appreciation of his courteous efforts.

CODLING MOTH.

Two years ago it was shown that spraying with paris green solution would save from 70 per. cent to 80 per. cent of fruit which would otherwise be destroyed by the apple-worm. It remained to be seen with how few sprayings this could be accomplished, and the minimum cost of labor and material. The solution used in the experiment the past season was paris green and water (1 lb.of paris green to 300 gals. of water) and whale-oil

soap in the proportions of 1 lb. to every 8 gals. of water. As this soap was used simply to secure an even spreading of the liquid and, possibly, to insure the permanency of the solution, I believe that ordinary soft soap would have answered the purpose equally well.

To this solution IXL was added, crushed in small pieces, 1 lb. of IXL to every 16 gals. of the liquid This, as is well known, is a patent insecticide consisting of lime, sulphur and salt and sold by Wm. Beck & Co., 112 California St. S. F. and 26 North Front St. Portland. Or. Cost in Portland 4 cents per lb. in bbls. (500 lbs. to bbl.) 4½ cents per lb. in 60 lb box and 5 cents per lb. in bricks, any quantity. It was used the past season because previous experiments appeared to indicate that fewer sprayings were necessary when it was used, and on account of its fungicidal qualities.

The first application was made June 12th. but rain interrupted the work, and, more rain occuring a few days later, this first spraying was disregarded and a second application made June 17th., five daye later. On June 27th. the fruit was sprayed for the third time, in reality the second time, and the fourth or really the third spraying was made Aug. 18th. None of the Waxen or Summer Sweets were treated on this last date.

On August 5th the fruit on the sprayed trees appeared to be quite free from worms, even on a few which were not treated on June 27th and had, therefore, gone seven weeks since the last spraying. Two weeks later, however, Aug. 18th, the Baldwins and Rambos were found to be somewhat wormy, showing that they should have received a spraying three or four weeks earlier. This would have brought the third spraying three weeks after June 27th, *i. e.* about July 18th. *The need of thorough work at about this date is referred to later on.*

The apple-worm, owing largely to the very inclement spring, was not as bad this year as the preceeding season, and unsprayed orchards looked fairly well in comparison with those which had been sprayed. In October, and earlier, the leaves on some of the trees in the sprayed orchard were noticeably burned, more particularly on the Baldwin trees. The cause of this cannot, in this case, be ascribed to using too strong a mixture, but in the following facts which have been discovered by previous experiments. It has been observed that trees in counties adjacent to, or near, the coast, are more likely to be burned than those in the interior. Further, if a *light rain* occur during or immediately after the application, the leaves are apt to be burned. Such burning does not show, when paris green is used, for sometime after the application. A heavy dew, or hot sunlight, immediately after spraying are conducive to burning. Strangely enough, it has been found that the older leaves are more susceptible to injury than the younger leaves. The under side of the leaf also is more easily burned than the upper side. The very slight rain occuring during our first spraying, June 12, aided by other climatic conditions prevalent here undoubtedly caused the burning of the foliage. This injury was but slight, and, another season, might be absent altogether. It must be said, however, that the presence of soap in the mixture appears to make it more liable to burn, than when used without the soap, and for that reason it would be well to use a min-

imum amount, just enough to cause the liquid to spread over fruit and leaf.

The effectiveness of wrapping burlap bands about the apple trees, as an adjunct to spraying, has been referred to before. Yet it must be borne in mind that the worm found beneath the band has accomplished its work, and spoiled the apple in which it was working. At the same time, many of the worms so killed, would, had they lived, produced female moths, which would have laid hundreds of eggs upon the fruit. In our experiments banding began in July, and the bands were examined every five days. In examining the bands, the greatest number of worms were found Aug. 25th, and Aug. 31st, 78 on the first date and 76 on the second,—from about forty-five trees. Inasmuch as it has been found that the larva lives four weeks in the apple before seeking a hiding place, it is evident that the mature worms found in such numbers from Aug. 25th—31st, were hatched about July 25th-31st,—*another argument to prove the necessity of a thorough application about July 20th*, in ordinary seasons.

I am convinced that three sprayings, with a fourth on later varieties, will, if judiciously applied, save a large percent of the fruit, and, as a result of the work of the past three years I unhesitatingly make to the farmer and fruit grower the following

RECOMMENDATIONS.

Spray with the solution above given for the first time about June 10th-15th, in ordinary seasons. A very early spring might call for an earlier application, yet it is very apparent that fruit growers, as a rule spray too early, there is no need for action until the apples are as large as marbles.

Let a second spraying follow the first in about three weeks, or a little earlier,—say July 1st—6th, and a third July 20th—25th. That should be sufficient on all early apples. A fourth is recommended for late apples Aug. 15th.—20th. These dates cannot be taken as criterions always, but they are based on careful observations here for three successive seasons.

As good a showing may be obtained, possibly, with some other agent in the place of IXL; we suggest it because with it we have had good results. Do not use too much of the solution, for it only makes burning more probable.

It might be well to decrease the amount of soap used, to about 1 lb. in every 15 gallons, just enough to cause the liquid to spread evenly over leaf and fruit. Begin banding about July 4th.

COST.

The large trees used in the above experiments were 30—40 years old and each tree required from 2 to 3 gals. of the mixture. This called for an expenditure of 7 cents per tree for each application, for labor and material. Smaller trees, requiring less, would not call for that sum.

It is an interesting fact, though having no especial bearing on our work here, that in Nebraska, in 1892, the Codling Moth caused a loss of $2,000,000, a very large proportion of which might have been saved by judicious spraying.

PROPOSED WORK

The Botanist and Entomologist are planning a series of experiments for the coming season to determine the practibility, as far as Oregon is

concerned, of combining fungicides with the arsenites, that the scab and other fungus diseases together with insects which prey upon apple, pear &c. may be killed with the same application. This operation saves the cost of a special treatment for either vegetable or animal pest, and is much to be desired.

HOP LOUSE.

This pest was not as bad this season as the year preceding, owing to the cold rainy spring, unfavorable to any insect life. The statement having been made, by a few hop growers, that kerosene emulsion, 1 part to 30 parts of water, injured the foliage of the hop plants, the Entomologist applied it considerably stronger, 1 part emulsion to 20 parts water, on hops planted on the College grounds. Even at this strength no injurious results were observed, and it must be concluded that the fault, in the cases referred to, lay in its manufacture or application, or both. Kerosene however in the hands of the uninitiated, is a dangerous agent, and our hop growers feel more confidence in the quassia soap remedy, or tobacco and soap, which compounds have frequently been quoted in publications emanating from the U. S. Department of Agricultnre, in bulletins published by this department of the experiment station, and elsewhere.

If opportunity offers, experiments will be instituted the coming season with a weak solution of Koebele's Resin Wash.* This wash promises to be a valuable agent against all forms of plant lice. It has in fact, already proved itself an efficacious agent. Its special value lies in the fact, that in a weak form it may prove fatal to the tender-bodied lice, and at the same time not kill the predaceous insects which feed upon them, and are found amongst them in considerable numbers.

The experiments proposed for next season are to determine how weak a solution will kill the hop lice and not injure the beneficial insects which occur on the hop.

It is propable that our hop growers will always have this pest to combat, and during some seasons, its ravages will be felt very severely if radical efforts are not made against it.

FLEA BEETLES AND RADISH FLIES.

Briefly, this experiment consisted in testing on turnips and radishes the comparative value of tobacco water (1 lb. of waste stems steeped in 2½ gals. water) air-slaked lime, and ashes as a preventive of the attacks of *Phyllotreta decipiens* and species of *Anthomyia*. The small "worms" found in minute brownish burrows near the top of radish and turnip roots are the larvae of the above flies. The result was a corroboration of previous work in this direction, viz. while lime and ashes are good, more frequent application are called for than when tobacco water is used. About three applications of tobacco water liberally applied with a watering pot, at intervals of two weeks, beginning when the plants are about a week old, will be found efficacious. As stated in a previous bulletin, this liquid is not only repulsive to the insect, but, sinking about the roots acts as an excellent fertilizer. Especially is this noticeable in the case of radishes.

The lime was applied to the plants with a Leggetts' London Purple

* RECEIPT FOR RESIN WASH: To 3 lbs of carbonate of soda (common washing soda,) add 4 lbs of resin and 1 gal. of water. Heat until dissolved, and while boiling gradually add 4 gal. of hot or warm water, stirring all the time, and continue the boiling until the mixture is the color of molasses When wanted for use, warm and dilute as follows with cold water: For Woolly Aphis 1 part wash to 6 parts water; for any other aphis 1 part wash to 10 or 12 of water: for Mealy Bug, 1 part wash to 10 parts water.

Gun (Leggett & Brother, 301 Pearl St. New York City) which is shown in a line cut below. By means of a strap which accompanies this machine and which passes over the shoulder of the manipulator, the gun can be held at the level of the waist, with the muzzle end just above the plants, and any dry insecticide easily applied.

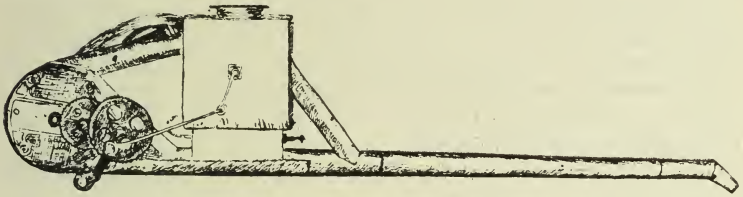


FIG 1.—Leggett's London Purple Gun.

Through courtesy of G. C. Davis of the Michigan Agricultural College we are privileged to insert here a cut from an original drawing of a machine of his invention, proposed, primarily to kill leaf hoppers, but also well adapted to catching and killing flea beetles on very young plants.

The machine is called a "hopperette".

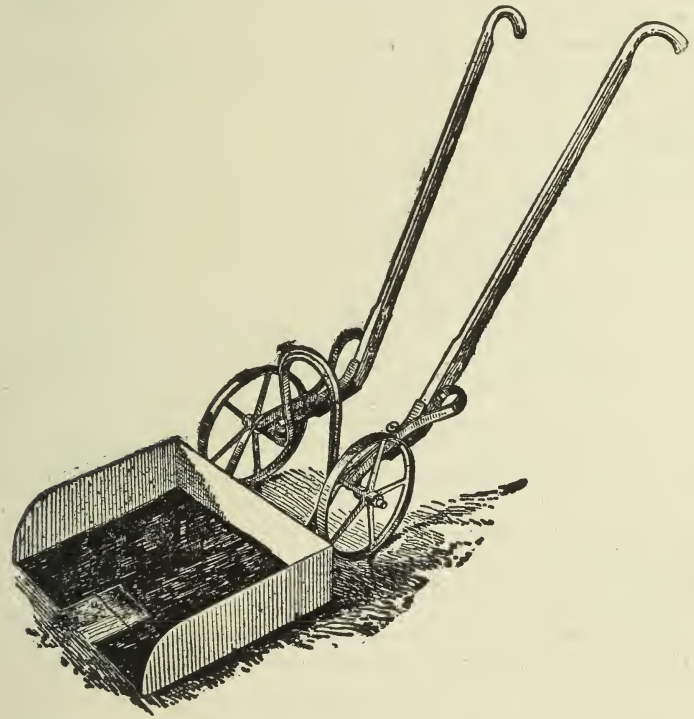


FIG. 2.— A Hopperette.

Quoting from his description: "A small tarred pan is attached to a hand wheel hoe as shown in figure. The pan is made of sheet iron. The bottom is 16 in. by 20 in. with a notch 6 in. deep by 4 wide cut in the centre of the front edge. On two sides and back is an upright sheet about 4 in. high. The edges of front edge and notch are rolled up about ⅛in. simply enough to keep the coal tar on bottom from rolling off.

The hopperette is attached to a wheel hoe by two strips of strap iron fastened under the pan as a support and at the other end bolted to the frame of the hoe. The carriage figured in cut is a "Planet Jr". sold by D. M. Ferry & Co. and listed in their catalogue at $4.00. The pan costs about $1 25. When used it is close to the ground and the young plants (celery plants, radishes, turnips etc.)are surrounded on sides and back by the edges of the notch. At *a* is a small string or wire which causes the insect to jump at the right time, and also prevents the plants from striking the sharp edge of the iron. As the machine is wheeled along and the plants disturbed as indicated, a large proportion of the insects will jump on to the tar and perish".

WIRE WORMS AND CUT WORMS.

Three plats each containing about 900 sq. ft. were treated May 10th. with Kainit & Muriate of potash, in the proportion of Kainit, 1000 lbs. to acre on one plat and 600 lbs. to the acre on another plat. On the third plat Muriate was applied at the rate of 600 lbs. to an acre. On two other plats, each containing about 450 sq. ft. the salts were applied in these proportions: Kainit 2000 lbs. to the acre, and Muriate the same. In each case, plats were left untreated to serve as checks.

On both treated and untreated plats, corn, tomatoes, peas, beans, and cabbages were planted. This season, as far as this valley was concerned, being exceptionally free from these sometimes very injurious pests, no result was obtained worthy of note beyond the increased growth of certain of the vegetables, due to the fertilizing qualities of the salts.

A few excellent preventives of cut-worm injury to garden plants are here appended. (*a*) When planting cabbage plants, tomato plants, etc., hold in the left hand a paper 3 in. square, and wrap it around the stalk of the plant in such a way that it will extend from about 2 in. above the ground to one below the surface. These papers can be easily cut, strung on a wire and carried about the field suspended from a button hole of one's coat.

(*b*) Throw old tomato cans and the like into a bonfire and allow them to remain until the two ends and the side become unsoldered. With a pair of shears cut the tin tube into two equal pieces lengthwise. Wrap each piece around a broom handle so as to form two tubes about 6 inches long and 2½ inches wide. When wanted for use, the tube can be sprung open to admit the stalk of the plant, and it should then be pressed into the ground about ½ inch.

(*c*) Hand picking of worms and digging them out from near a plant which they have cut has already been referred to.

TENT CATERPILLARS.

These pests have been so prevalent the past season, that remedies and

preventive measures, which were given in Bulletin No. 14 are here repeated. The hairy larvæ, so prettily marked, are by this time very well known to our citizens. They turn into moths much like the one figured on the title page of this bulletin.

Where fruit trees are sprayed with the arsenical solutions for the codling moth the foliage is necessarily poisoned, and the above caterpillars being leaf eaters, are killed by eating the leaves. A very excellent, and very necessary preventive is to destroy the egg clusters on the leafless trees in autumn, winter, and early spring when they can be easily seen, by cutting off and burning infested twigs. The eggs are clustered in a dark band around the twig. Another remedy is equally simple; saturate a rag with kerosene, attach it to a pole, light it and burn the webs when the caterpillars are within. Crushing the very young caterpillars with the gloved hand, when they are massed together, is also recommended. Several parasites attack this larva, so man is not alone in his efforts to destroy them. A few of our birds, but not many, feed upon these pests. The eggs of *Clisiocampa* found in August will not hatch until the following spring.

GOPHERS AND MOLES.

The station has obtained a sample of the breech-loading Breese Riggs Animal Gun, invented, manufactured and sold ($3.00) by Miss Emma Riggs of Crowley Or. The principle involved in its use is the same as in the muzzle-loading Dikinson Gun figured in Bulletin No. 25.

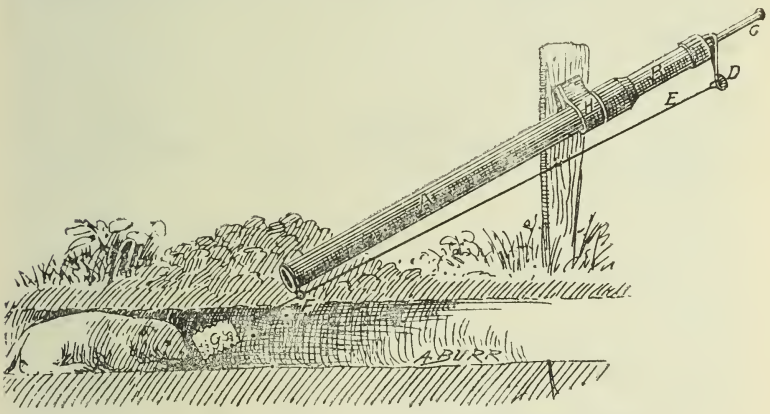


FIG. 3.—The Breese Riggs Animal Gun.

The hard wood stake to which it is attached is driven into the ground and the barrel can be pointed down the burrow at any angle. It calls for a 16 gauge shell, a very light charge of powder (about 1½ thimbles full) and about 30 pellets of No. 6 shot. We regard it as a very efficacious machine, and the fact that it is a breech loader makes it an easy gun to load or unload.

Moles can be shot with an ordinary shotgun, if one is so fortunate as to have such a weapon when he observes the earth of the mound moving. Such movements indicate that the mole is just below, and a good marksman can kill the animal when standing 25 or 30 feet away. Spearing them

when so engaged has been referred to in a previous bulletin. The so-called "Mole plant" (*Euphorbia lathyris*) is thought by some to prevent depredations, of moles at least, when planted in gardens. This idea however meets with but little encouragement from close observers.

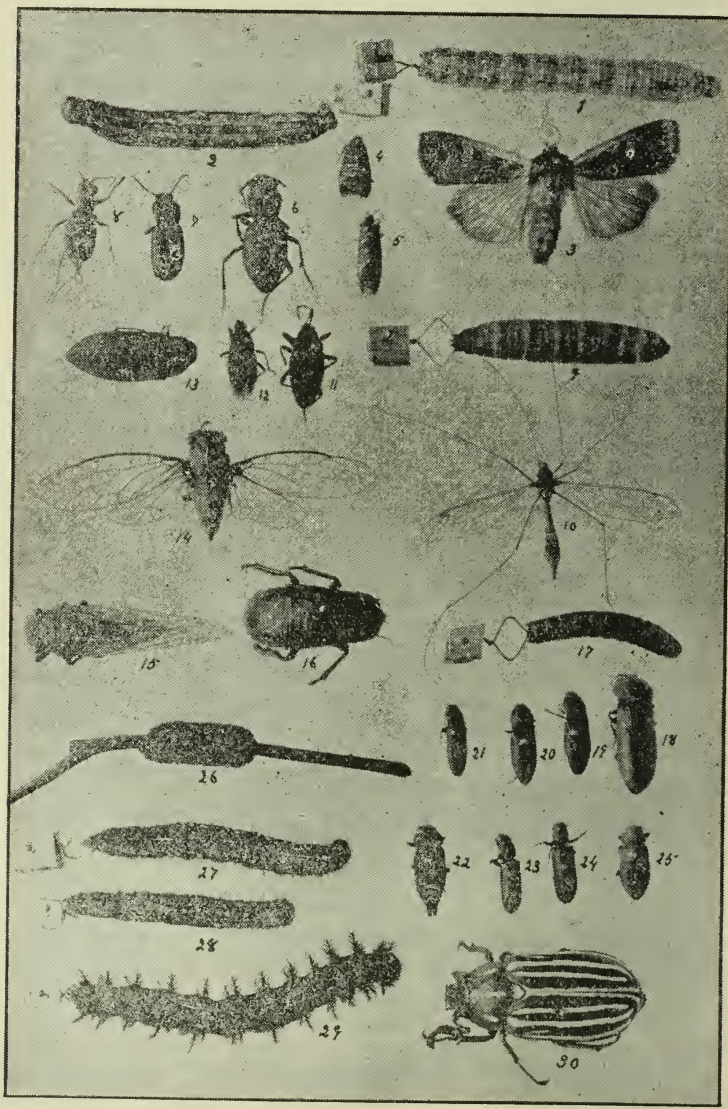


PLATE I.

EXPLANATION OF PLATE I.

Figs. 1 & 2, Cut worms, *Hadena devastatrix* and *Leucania* (Sp?) respectively. Fig. 3, Moth (*Rhynchagrotis confusa*) from cut worm. Figs. 4 & 5, Codling Moths. Fig. 6, *Omus californicus* a predaceous beetle and hence a beneficial insect. Fig. 7, Another predaceous beetle (*Pterostichus californicus*). Fig. 8, *Cicindella 12-guttata*, a Tiger Beetle, predaceous in habits and commonly regarded as a useful insect. Fig. 9. Larva of Crane Fly. Found in decaying vegetation. Fig. 10. Perfect insect or imago of Crane Fly. Fig. 11. *Largus succinctus*. Fig. 12. *Leptocaris trivittatus*. This and the preceeding belong to the order known as Hemiptera or bugs. They are abundant, frequently seen about maple trees, and also feed on the juice of bruised cherries, berries etc. Fig. 13 A beetle which bores in fir (*Buprestis aurulenta*) quite common in Oregon. Fig. 14, *Cicada areolata* (allied to 17-year Locust) with wings expanded. Fig. 15, Same with wings closed, Fig. 16, Pupa of a Cicada. Fig. 17, A wire-worm; injures wheat, tomato plants, potatoes, beans, etc. Fig. 18, Click or Snapping Beetle which comes from the wire-worm. Fig. 19 and 20, Two Click beetles (*Corymbites fabrax*). Fig. 21, Another Click beetle (*C. cylindriformis*). Fig. 22, *Dicerca divericata*, a beetle frequently seen on peach, cherry, or prune trees. Its larva bores in the wood of these trees just below the bark and resembles the larva of the Flat-headed Apple-tree Borer (*Chrysobothris femorata*) Fig. 23 and 24 Branch and twig borer, (*Polycaon confertus*,) Fig. 25, The beetle which comes from the Flat-headed apple-tree Borer, (*Chrysobothris femorata*). Fig. 26 Eggs of "Tent Caterpillar" Fig. 27 and 28 "Tent Caterpillars" larva of *Clisiocampa* (*C. pluvialis* and *C. erosa*, respectively) Fig. 29. Larva of *Pseudohazis eglanterina* which feeds on Wild Rose. Fig. 30. "Ten-lined leaf eater" *Polyphylla decemlineata*.) Its larva feeds on roots of grass.

All figures in Plate I but slightly reduced from natural size.

PLATE II.—SOME SAMPLES OF INSECT WORK.

I. Woolly Aphis (*S. lanigera*) on apple.

II. San Jose Scale (*Aspidiotus perniciosus*.)

III. Oyster-shell Scale (*Mytilaspis pomorum*.)

IV. Work of Scolytid Borers on young Baldwin. Piece of bark removed to show burrows.

V. Work of Blackberry and Raspberry Cane Borer.

VI. *Corythuca* on under side of Apple leaf. This insect has been reported to the station at various times but is not numerous enough or injurious enough to be regarded as a pest.

VII. Work of Pear and Cherry-tree Slug.

VIII. Currant stem hollowed by the Currant Borer.

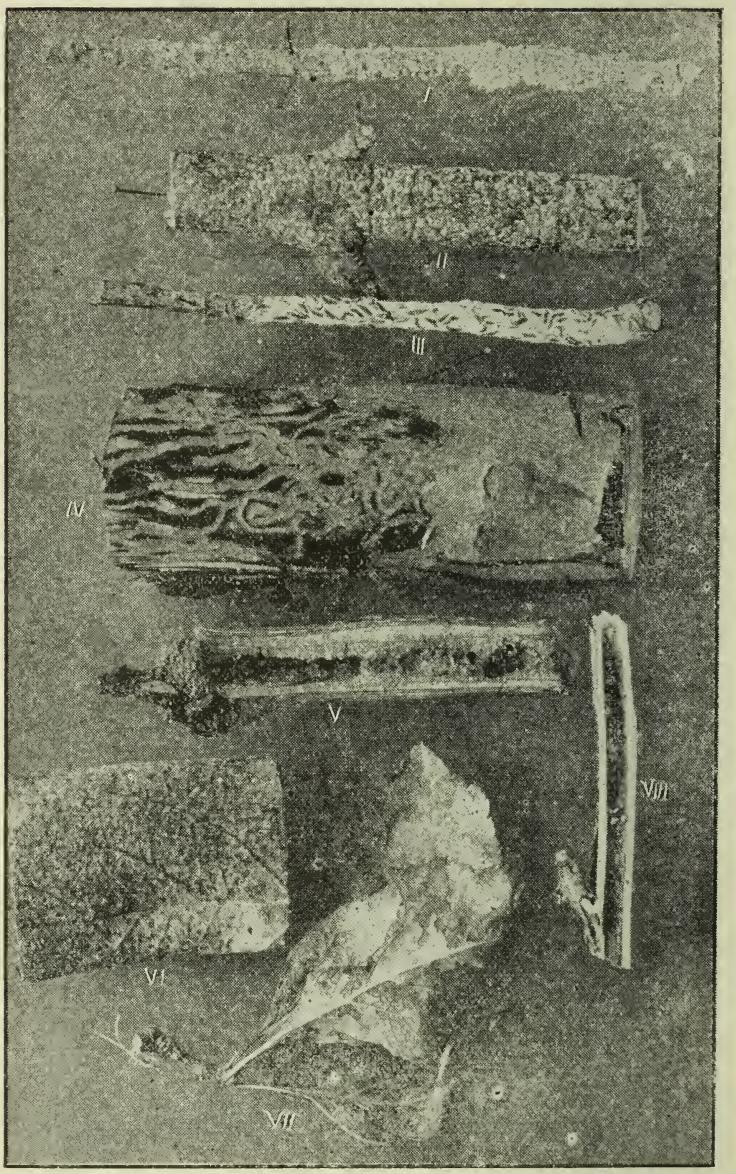


PLATE II.

CAPONS AND CAPONIZING.

F. L. Washburn.

WHAT IS A CAPON?

A capon bears the same relation to a cockerel that a steer does to a bull; it is an altered rooster. As in the case of steers, a capon is more quiet, lays on much flesh and fat and remains tender for many months after the operation. Caponized birds 17 and 19 months old have been killed here whose meat was extremely delicate snd tender. They will, furthermore, weigh from 20 to 30 per cent more than a rooster of the same age if kept the proper length of time, and, in many Eastern markets will bring from 18 to 30 cents per pound. The comb and wattles do not grow after the operation. The feathers of neck and saddle grow enormously long and become very glossy. They do not chase the hens; they neither crow nor fight. For a few months after caponizing they are very hearty eaters. but later do not consume appreciably more food than ordinary fowls. If the operation does not succeed in removing all of the testicular matter or the sac (*tunica vaginalis*) inclosing it, the glands grow,—sometimes to an enormous size, and assume distorted shapes. The bird is then what is known as

A SLIP.

A slip gains flesh and fat and better flesh than a cockerel,--grows rapidly, and for a time resembles, as far as outward appearances go, a genuine capon. But after a while,—three or four months after the operation, the comb and wattles grow, the bird developes a crow, and chases the hens worse than a cockerel. It is evident that its period of gain has at this point ceased and it should be killed without delay. The meat of a slip is superior, as said above, to that of a cockerel and in some markets sells for nearly as much per pound as that of a capon.

IS THE OPERATION CRUEL?

No more so, and not so much, as the same operation performed on pigs, colts and calves. It is quickly done, and the bird begins to eat directly after being released from the caponizing board. Not over 2 per cent of birds need be lost by even an indifferent operater, and any chick so killed dies from hemorrhage and is as good for table use as though death had been caused by beheading. The beginner should practise on two or three dead cockere's first, in order to become familliar with appearance and position of organs before attempting to handle a live bird.

INSTRUMENTS NEEDED.

Caponizing instruments are sold in sets by Geo. Q. Dow, North Epping N. H., by W. H. Wigmore and Co. 107 So. 8th St. Phila.. the latter firm represented on this coast by the Petaluma Incubator company, Petaluma, Calif.,—by Geo P. Pilling & Son 116 South 11th St., Phila., and others. Single instruments can be purchased from most of these firms, as shown in their catalogues. These tools sell, in sets, for from $2.00 to $5.00 and over. The instruments actually necessary are a sharp penknife or scalpel, a spring or spreader. Fig. 4 (A & B) to keep the ribs apart, a caponizing canula Fig. 4 *C*. in some form, a delicate steel hook Fig. 4 *D*, and a pair of fine long

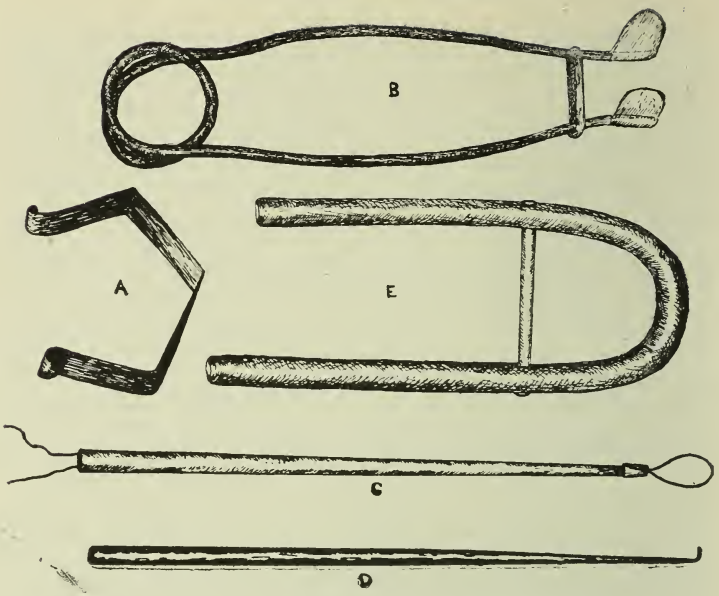


FIG. 4.—(All figures in this group are about ½ actual size.)

forceps. To these might be added a pair of small sharp pointed scissors. One should have also an oval caponizing board (Fig 5.)

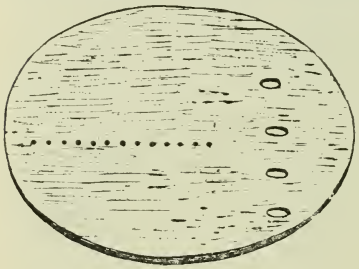


FIG. 5.

The board we used is 2 ft. by 1½ in its two diameters. Eight inches from one side is a row of thirteen holes ¼ in. in diameter and one and one half inches from each other. At one end are four oval holes about 1½ in. long aud ⅝ in. wide, (see Fig. 5,) The small round holes are to hold the ends of the staple, Fig. 4 *E*, which passes over the wings of the fowl. Through the oval holes a double strap is carried over the *scaly part* of the legs and, by means of a weight at the end beneath the board, holds them firmly. The iron staple, which is used as above indicated, is four inches long, with a cross bar 1½ inches from the rounded end. The staple must fit snugly in the round holes. The distance between any two of the round holes is just one half the distance between the free ends of the staple. The hook, Fig. 4 *D*, can be made from a dentist's pick or from a crochet needle, and is used to tear the delicate membranes found in the body cavity of the fowl, and concealing the viscera. A spreader Fig. 4 *A* can be made with a well tempered piece of steel. It

is 2½ in. wide and each arm is 1½ in. long. Allowing for the turning up of the ends, the peice of steel from which this spreader was made was about 6½ in. long, and ⅜ of an inch wide. Such a spreader should be very pliable. The spreader represented at *B* Fig. 4, which can be purchased for a small sum is to be preferred for young birds, and the stronger spring should be used only when the ribs do not yield easily; at which time, by the way, the bird should not be caponized. A caponizing canula can be purchased. The one used here, however, Fig. 4 *C* was made from a blow-pipe which had its smaller end flattened and just enough of a slit left at this end to allow of the passage of the wire loop. We prefer fine silvered wire (Malin & Co No. 32) to the horse hair used by many. The spreader shown above, Fig. 4 *B*, is somewhat too long and we would reccommend the shorter improved style shown in Fig. 6.

THE OPERATION.

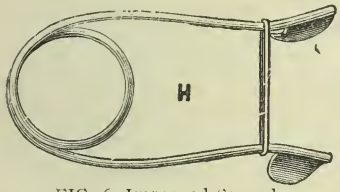


FIG. 6. Improved Spreader.

The bird, which should be between 2½ and 4 months old, has been kept without food or water for 24-30 hours in order that the intestines may be perfectly empty. It is placed on the caponizing board, its wings pinioned with staple (do not press wings too closely together) and its legs fastened firmly by the weighted strap referred to above. The board has been placed on a barrel, say, or something of the proper height, and preferably out of doors, where plenty of light, direct sunlight if possible, is obtainable. It is well to wet the feathers on side, in front of thigh, that they may the better be kept out of the way. Brush them back to bare the

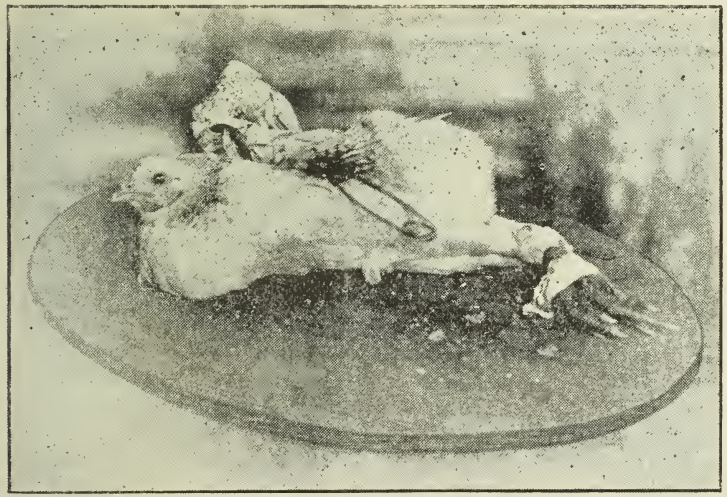


FIG. 7.

skin. With a scalpel or sharp pen-knife cut through the skin at right angles to back-bone, and half way between shoulder and thigh. Let this cut be about 1 in. long or more. Then push the skin back and cut through the muscles *between the last two ribs*. Insert spreader to keep ribs apart. Your bird will then have something of the appearance shown in Fig. 7. Allow no foreign matter, feathers etc,, to fall into the cavity while operating. With hook tear away the delicate tissue which you see hiding the intestines. This tissue is the wall of an abdominal air-sac. The intestines exposed, push them to one side and note the testicle of the side upon which you are working, lying close to the back and about on a level with the front edge of the thigh. It is an oval body, generally whitish, but not constant either in size or coloration. If the chick is very young it may not be much larger than a grain of wheat, but in the larger breeds of fowls, at four months of age, it will be considerably larger, and in quick growing fowls, like the Leghorns[and, by the way, it does not pay to caponize these] the glands at four months, may be nearly as large as a sparrow's egg. Note the blood vessels close to the testicle, and sometimes directly in contact with it, running along the back in the middle line; the pulse in the artery [*dorsal aorta*] is distinctly visible. Insert caponizing canula and place wire loop over testicle. Extreme care must be taken *not to include either of the large bloodvessels in the loop.* If you tear either of these your bird will bleed to death. At the same time the entire gland must be included; *failure in this particular means a slip.* Now keep the end of the canula closely applied to the gland and draw upon the wires firmly. The result is that the wire cuts the testicle free from the tissue supporting it and it can be picked out of the abdominal cavity with the long handled forceps. With forceps also, or with spoon, remove all foreign particles which may have got into the abdominal cavity such as peices of feathers, clotted blood etc. The spreader is then removed, the skin drawn over the cut beteen the ribs and the two edges of the skin stitched together. This takes a little more time, but we believe it is far more humane than just twisting the feathers together. Turn the chick over and repeat the operation on the opposite side. Many professional caponizers remove both glands through the same cavity, *i. e.* open only one side of the bird, but it is hardly advisable unless one has the finest set of instruments, the Chinese tools for instance, and has become very expert in their use. The bird is then placed in a dry coop, and given plenty of water and soft food frequently (but not two much at a time) for three or four days and then allowed to run with the other fowls. Sometimes a bird becomes "wind-puffed" a few weeks after the operation. In other words, when the cut in the skin has healed, air gets between the skin and the muscles, from the broken air sac. This can be easily remedied by puncturing the distended skin with a coarse

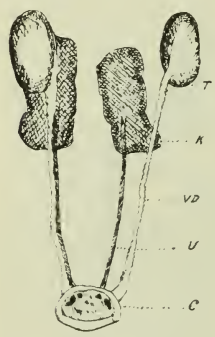


FIG. 8, Urogenital organs of male fowl: T. *testicle*, V D. *vas deferens*, K. *kidney*. U. *ureter*, C. *cloaca*. (reduced.)

needle and forcing the air out. Or, if left alone, it will eventually remedy itself.

BEST BREEDS, AGE, ETC.

In our estimation the Light Brahmas or the Plymouth Rocks make by far the best capons. The black Langshans are excellent also, albeit they are very slow growers. Partridge Cochins are highly spoken of. The Indian Games make fine capons, as well as crossses of this species on other large breeds. A turkey was caponized here the last season, but results are not definite enough to warrant a report yet.

As to age, many caponize as soon as they can distinguish the sex of the chick. The important point is not to wait until the glands are large and the ribs become stiff, and unyielding.

EXPERIMENTS AT CORVALLIS,

These experiments were not intended to give results in minute detail. That will come later perhaps, when a flock of capons can be kept at the Experiment Station. The conditions under which the work was done here has been purposely made the same as would be found on any farm. The capons were given no special care nor special food, and the results show conclusively a gain over birds untreated. About thirty fowls were used in the experiments. Two or three of the first caponized were accidentally killed. A few proved slips. Untreated roosters of the same species and same brood were used as checks in many cases, but, owing to the fact that all the birds belonged to the writer's flock, it was impracticable to keep checks for each bird caponized, hence the apparent meagerness of the report in this direction. The following table gives the data as regards comparative gain of a few of the subjects, enough being quoted to give a fair idea of the experiment.

No.	Breed.	Date of Caponizing.	Age and weight at operation.	Date of 2d weighing & amount of weight.	3d weight.	4th weight.	Date of killing and age at death.	Live weight at death.	Weight dressed.
13	Cross; Plymoth Rock & Brown Leghorn.	Nov. 20 1891	5 months 2lbs 15½ oz.	Feb. 3 1892 4¼ lbs.	Mar. 12 1892 5lbs		Aprl. 9 1892 10m 21d	5lbs	3½lbs
14	Same; check on No. 13.		2lbs 8½ oz	4lbs.	4lbs		"	4lbs	2½lbs
12	Black Langshan.	Nov 20 1891	5 months 2lbs 11 oz.	Feb. 3 1892 6lbs.	Mar. 12 1892 7¼ lbs	Aprl. 30 7¾ lbs	Dec. 9 1892 17m 19d	10½lb	7¾lbs
25	Light Brahma.	Dec. 11 1892	5 months 3lbs 6 oz.	Feb. 1 1893 6½lbs	Sept. 12 1893 8lbs	Feb. 12 1894 8⅛ lbs	Feb. 12 1894 19ms.	8⅛lb	6½lbs

No. 12, In excellent condition. No. 25, In good condition. see Plate III.

No 12 shows an average gain per month, after the operation, of 9.9 oz. The check on No. 12 was not kept as long as the capon, for lack of facilities, but during eight months time, it showed an average gain of 6 oz. per month. Number 25 should have been killed in Sept. 1893 for, as shown in table, there was hardly any appreciable gain after that time. The bird is figured alive and dead in Plate III at the end of this bulletin.

HOW TO PREPARE A CAPON FOR MARKET.

Keep the bird twelve hours without food, that its crop may be entirely empty. Then suspend by the feet in a convenient place. Have ready a two or three pound weight attached to a hook. This is to fasten to the lower mandible or "lower jaw" of the bird after he is dead to keep him steady and facilitate picking. Seize the head of the fowl, open his mouth and cut the veins and arteries [jugulars and carotids] at the back part of the throat by running a sharp-pointed knife into the back of the mouth. a French Poultry Killing Knife is made expressly for this purpose. As soon as blood vessels are cut, run the knife through the roof of the mouth into the brain. Then pluck the bird immediately, without scalding. This method is most approved of by experts, as the bird is not in any way disfigured. One may cut both of these bloodvessels from the outside by running a sharp pen-knife into one side, a little back of and below the ear, thus making only one wound. This one wound however might be objected to by the marketman. *Never chop off the head!* In plucking, the feathers of the two outer joints of the wing, the feathers of the upper part of the neck, the tail feathers, together with the long feathers of the saddle, and a few feathers on the lower end of the drumstick should be left [See Plate III]. Do not cut off the feet. If the head is bloody, wash off the blood. As regards dressing; cut carefully around the vent and pull out the intestines, scraping off the fat with which they are covered and leaving it (the fat) in the body cavity, when the end of the intestines is reached, break them off just below the gizzard. Leave gizzard and every-thing else, except the intestines, in the bird. Turn the mass of fat, around the opening you have made, outward, and let it harden, it will improve the appearance.

Capons should be packed, when thoroughly cooled, in new boxes lined with white paper. They should be packed solid, backs up, care being taken not to bruise them. This is the approved way of preparing a capon for the market. Buyers of capons at once recognize it as the bird calling for 30 per cent more per pound than an ordinary fowl. For our own use, however, we should never take such pains; it is recommended because such a method obtains fancy prices.

THE BEST AGE FOR KILLING.

On this point opinions seem to differ. One authority says: "Capons should be kept until two years old; another, Mr. Cushman of the Rhode Island Experiment Station, says "Capons killed at eleven months of age are preferred, as they get coarse and "soggy" if kept until twelve months or longer". In spite of this last assertion we have found at least two capons, Nos. 12 and 25 to be in good condition at 17 and 19 months, and they certainly gain after twelve months. As far as our experience goes we would recommend keeping them at least thirteen or fourteen months from date of hatching.

WILL IT PAY IN OREGON.

Unless fowls are sold by the pound it ceriainly will not pay from a financial standpoint. In Portland, we understand, and in a few of our other

large cities, the practice of selling poultry "by the dozen" is gradually disappearing. When fowls are sold by the pound, as they should be, it will be an easy matter for the raiser of capons to successfully compete with those furnishing the scrawny tough fowls now displayed in our markets.

Quoting from a list of prices in Boston Market for 1891 and 1892 we find that from Jan. 1st to May 15th. New Jersey Capons sold for from 20 to 28 cents per pound. At the same time broilers were bringing from 15 to 55 cents per pound. When capons are scarce, which happens in early summer, they bring much more per pound. On July 7th 1892 capons weighing nine and ten pounds were retailing in Fulton Market, New York City, for 35 cents per pound. The latter part of May 1891.—a member or the firm of Edson Bros. and Gilman wrote to Mr. Cushman of the Rhode Island Experiment Station, that he could that day sell a ton of capons, if he had them, at from 26 to 28 cents per pound.

It is probable, that if our wealthy people could be educated to the point of appreciating capon meat and they would doubtless prove apt pupils, this favorite of epicureans would command good prices in Portland and elsewhere throughout Oregon. A market man in our metropolis told me a short time since that he had no doubt but that fancy prices could be realized on capons, and expressed a willingness to contract for a large number for February. He did not, however, state what he would pay for them.

The use of the incubator, in order to bring capons on the market all through the year, and in large numbers, is, very evidently, a necessary adjunct to the business as well as an absolute necessity in the production of early broilers on a large scale.

NOTES

No antiseptic precautions were taken in our experiments.

A physicians head mirror strapped to the forehead will enable one to perform the operation by lamplight. Such a mirror can be purchased for from $5 to $6 of Geo. Tieman & Co. New York City.

Are slips fertile? Can they be used for breeding purposes? This question we attempted to solve a year ago, by placing a slip with a hen just beginning to lay while cooped with her chicks She had been separated from the rest of the flock for about five weeks. For a week after the introduction of the slip into her yard, each egg laid was tested in an incubator and none were fertile.

Another experiment along the same line gave practically the same results, and, though, the experiment *must not be regarded as by any means conclusive* it would seem, that, owing to mechanical injuries incurred in the operation, slips as a rule cannot be used for breeding purposes. It is easy, however, to imagine exceptions.

In the course of this latter experiment, an interesting fact, though not a new one to many, was brought out. It was necessary that the hen used in the experiment should be laying sterile eggs, and to insure this the eggs of the isolated hen were tested daily in an incubator. *Each egg so tested proved fertile until the 17th day after isolation*, at which time the slip was placed in the pen.

Professionals have written to us stating that, when a fowl believed to be a capon is observed treading a hen, such fowl must necessarily be a slip. This is directly opposed to our observations. Capons were occasionally seen to bristle up to a hen and at other times to tread. Such fowls when killed were dissected and carefully examined, but not a trace of testicular tissue was found, and both *vasa deferentia* (the "cords") were rudimentary, that is, had not grown to any extent since the operation. It would seem that the genuine capon is as likely to show this instinct, as a steer in a drove, or cows at pasture.

Quoting from a very excellant bulletin on the subject of caponizing from the Rhode Island Station; "Large birds sell the best; the heavier the better. When ten pound birds bring 22 cents, 25 cents will be given for twelve pounders and 28 cents for those weighing fourteen pounds.

Some workers in this line claim to be able to caponize a bird in five minutes or less, but such do not sew up the wound.

Do not use fingers in removing glands or any spoon forceps recommended for twisting off the testicles. We have found caponizing canulas which allow of the wire being pulled through them, thus cutting off the esticle, superior to anything else and we would heartily recommend them. Others may have had a different experience.

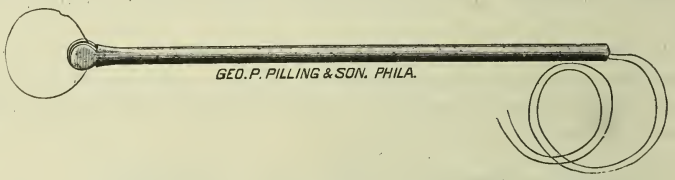


FIG. 9. The Pilling Canula, made by Geo. P. Pilling and Sons. Philadelphia.

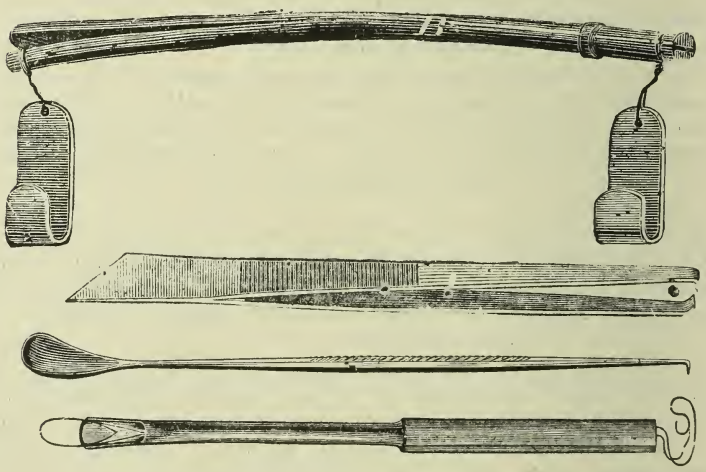


FIG. 10.— A whale bone spreader in the Chinese set of tools; a combined knife and forceps and a combined spoon book, also in this set. The last illustration is a canula made by Wigmore and Co.



PLATE III.

As mentioned before we found fine silvered wire, Malin No. 32, preferable to horse-hair, yet much of our caponizing has been done on birds a little old for the operation. For very young birds a horse-hair, single or double might answer.

Of books published by dealers in caponizing instruments we have "Capons and Caponizing" by G. Q. Dow 1890 (25c) "Practical Caponizing" by W. H. Wigmore 1887 (25c) "Guide for Caponizing" by G. P. Pilling 1892 (free) "Capon Hand-book" by Greely Bros. 1892 (10c).

To Mr. Garrison of Forest Grove, dealer in fine poultry we are indebted for numerous favors and take this oppnrtunity for acknowledging same. On the front page of this bulletin is a picture of two brothers Partridge Cochins, one a capon, the other a rooster. The difference in their heads is at once striking and characteristic. They are 11 months old, weight of rooster 7 lbs. 2 oz.; weight of capon 8 lbs. 2 oz.

We have been in the habit of wrapping a rag around the cross peice of the staple [see Fig. 4 *E*] thereby forming a cushion which rests against the wing of the bird during the operation.

EXPLANATION OF PLATE III.

The chief figure in this plate is a capon [No. 25] properly dressed for market, though professionals would have left more long feathers on the wing. Note the absence of comb and wattles, the full rounded breast, the presence of fat over the entire body, and the absence of sharp angles any where. In the upper left hand corner the same bird is shown as he appeared just before being killed.

OREGON AGRICULTURAL EXPERIMENT STATION.

Bulletin No. 32. November, 1894.

BOTANICAL DEPARTMENT.



Five Farmers' Foes.

Canada Thistle. Bull Thistle.
Sow Thistle Chinese Thistle.
Russian Thistle.

MOSES CRAIG, Botanist.

The Bulletins of this Station are sent free to all residents of Oregon who request them.

AGRICULTURAL COLLEGE PRINTING OFFICE.
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CORVALLIS, OREGON:
1894.

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FIVE FARMERS' FOES.

CANADA THISTLE.--(*Cnicus arvensis*, Hoffm.)
BULL THISTLE.--(*Cnicus lanceolatus*, Hoffm.)
SOW THISTLE.-- *Sonchus arvensis*, L.)
CHINESE THISTLE.--(*Xanthium spinosum*, L.)
RUSSIAN THISTLE.--(*Salsola kali*, L. var. *tragus*, DC.

Every farmer wishes to increase the quantity of his crops and the Experiment Station wishes to aid him in so doing. This result may be gained in two ways: By increasing the acreage, or by giving the plants more food and better care. Large farms are apt to be neglected, so increase of land under cultivation frequently fails to give a proportionately increased crop. One cause of this is the weeds which creep stealthily in crowding out the crops from which they take moisture and food. We believe that if people really understood how much is annually lost in this way they would immediately take bold steps to free themselves from these pests.

PURPOSE OF THE BULLETIN.

The object of this bulletin is to call the attention of Oregon agriculturists, and others interested, to the large crops of weeds annually grown on their farms and to describe some methods of preventing this injury. There is a great difference in weeds, some are easily eradicated while others defy the best efforts of careful cultivators to destroy them.

Prominent among the latter class are the Thistles, and with them we group some plants which though not true thistles are frequently mistaken for them. The more thorough our knowledge of these plants, their nature and habits, the more effective will be the means of destruction.

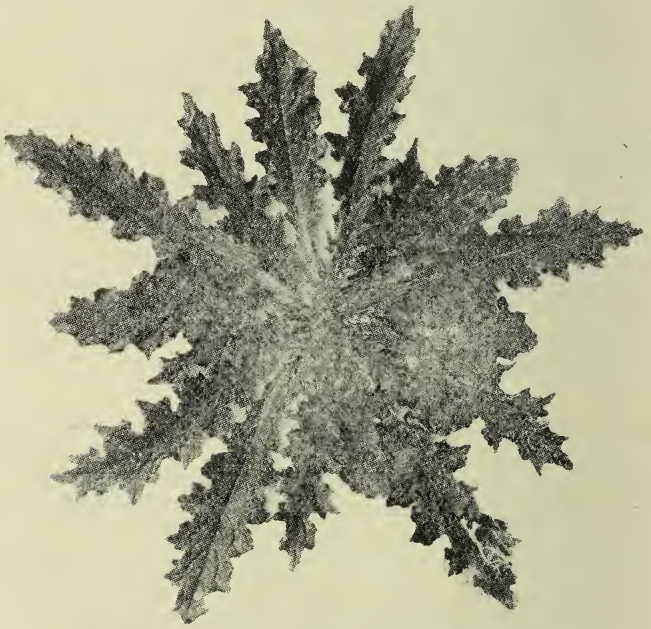
Every farmer should know three things about weeds, namely: How weeds get on a farm, the character and amount of injury they are likely to cause, and how to best destroy them. So before studying the thistles in detail it may be well to consider briefly weedy plants in general and try to answer the above questions.

HOW WEEDS GET ON THE FARM.

Most weeds are propagated by seed which is produced in great abundance and modified in various ways to aid in their distribution. The roots

or seeds of some seem ever in the soil ready to sprout and grow whenever a favorable opportunity offers.

The interesting subject of plant distribution may be considered under three heads, first the provisions made by nature in the plant itself which may be either structural or physiological, second the natural forces that act as aids in distributing the plants and last though not least the agency of man. Under structural provisions come modifications of the fruit, such as pappus of which the thistle down carried by the wind is a familiar example, hooks as in the cockle-bur by which the burs fasten themselves to the hair of animals and are thus carried from place to place, or modifications of the seed as the hair of Milkweed (*Asclepias*) or the winged seed of Catalpa. Under physiological provisions we may have prolonged vitality of the plant, a seed covering attractive to birds, or a sticky exudation as in the Tarweed (*Madia*). Among the natural forces aiding in the distribution of plants are winds, streams, fish, birds and cattle.



LEAVES OF BULL THISTLE.

That roads and railroads are great factors in weed distribution is apparent to all who have noticed the number and variety of Eastern plants growing along these lines of traffic. The seeds of many plants are annually emptied upon our shores in the ballast left about sea-ports by vessels from foreign countries, or travel westward over the mountains in the straw and chaff used for packing goods. Some of the worst weeds are thus brought from a distance but many come from neighboring fields or roadsides occupying valuable space and if allowed to ripen seed will reappear in greater numbers the next season.



CANADA THISTLE.

Sometimes they spread so rapidly as to require concerted action to destroy them; to this class belongs the Canada thistle which spreads both by seeds and by underground stems rendering its destruction very difficult where it is once established. The diligent farmer may free his farm from weeds one year, only to find that a shiftless neighbor has raised a crop of thistles to re-seed his farm and necessitate a yearly repetition of this labor. No wonder the farmer becomes discouraged after a few years experience of this sort and soon his fields are as bad or worse than his neighbors.

Thoroughness is the secret of success and weeds cannot be successfully combatted without the earnest cöoperation of all land-owners in the county, since one farm overrun with weeds which are permitted to ripen seed is sufficient to seed a township. If all the farmers in a given territory would unite in keeping down all bad weeds and not let one escape for three years they would be surprised to see how few of these pests would remain.

The most perfect co-operation however is that enforced by law. An effective weed law vigorously enforced is a blessing to any state. Let us enforce our present laws and try to have others enacted including more of our worst weeds.

OREGON LAWS FOR EXTIRPATING WEEDS.

As far as we are able to ascertain there is no law in this state requiring the destruction of any weed except the Canada Thistle and the Dagger Cockle-bur. There are however several plants that are becoming so troublesome in different parts of the state as to require united efforts for their destruction. We desire to call especial attention to the following weeds, in addition to the five described in this bulletin, and urge that they be included in the weed law before they become thoroughly established:

French Pink (*Centaurea cyanus, L.*)
Dog's Fennel (*Anthemis cotula*, DC.)
Tarweed, (*Madia* species.)
Wild Mustard (*Brassica campestris, L.*)
Ox eye or White Daisy, (*Chrysanthemum leucanthemum*, L.)
Moth Mullein (*Verbascum blattaria, L.*)

It will be noticed by some that in the plants mentioned above the common or English name is followed by another printed in *italics*. This is the scientific or Latin name used by botanists the world over, while the common name changes even in different parts of the same county. The letter following the Latin name is the initial of the botanist who first described the species.

Our present law is insufficient because it does not tell exactly what plant is meant, thus one might be uncertain whether "Dagger Cockle-bur" means *Xanthium spinosum*, L, *Gilia squarrosa*, H. & A., or some other plant. All uncertainty would be removed by the use of the Latin name.

On account of the difficulty, experienced by some, in distinguishing between the Canada and Bull Thistles would it not be well to put them both under the ban? They are both bad weeds.



ROOT OF CANADA THISTLE.



FLOWER OF BULL THISTLE.

CANADA THISTLES MUST BE DESTROYED !

An act for the Extirpation of the Canada Thistle:

SECTION 1. It shall be the duty of the Supervisors of the several counties in this State, in addition to the duties hitherto prescribed by law, to cause the destruction, in the manner which to the said supervisor shall seem the most effective, of the weed known as the Canada thistle, where such weed shall be found growing upon the public highways and county roads of this State.

SEC. 2. The road supervisor of each road district in this State shall immediately after this Act takes effect, and from time to time thereafter, ascertain whether or not there is any weed known as the Canada thistle in his road district, and shall as soon as he ascertains that there is any of said weed, notify the county court of his county in writing at a regular session thereof of the existence of said weed, and upon whose land the said weed is growing. As soon as the county court has received said information said court shall appoint a householder in said road district as a commissioner, to hold office for the term of one year, whose duty it shall be to cause the said weed to be extirpated wherever found within said district.

SEC. 3. When the commissioner aforesaid is appointed it shall be his duty to ascertain from the road supervisor of his district the exact location of said weed, and he shall then notify the owner of the land upon which it is growing of its presence thereon, and request said owner to effectually remove said weed from his land; and in case the residence of the owner is unknown or is so far away that he cannot be notified, or, if notified, can not attend to the extirpation of said weed within a reasonable time, then it shall be the duty of the commissioner to notify the occupant of said land and request him to extirpate said weed from said land.

SEC. 4. If such owner or occupant shall fail or refuse to destroy such weed after being notified by the commissioner of the existence of such weed upon his land, then it shall be the duty of said commissioner, and he shall have authority to go upon said land and cause said weed to be extirpated from said land in the manner which to him seems the most effective. The expense of destroying said weed on said land shall be paid upon proper showing made by the commissioner out of the county funds, and shall be and remain a charge upon said lands, to be assessed to said land and collected the same as taxes:



BULL THISTLE.

provided, that the same may be remitted by the county court at any regular session thereof upon the petition of ten resident householders of the precinct where said petitioner resides.

Sec. 5. The commissioner shall receive from the county for his services, specified in sections 3 and 4 of this Act, the sum of two dollars per day actually employed.

Sec. 6. If the road supervisor or commissoner mentioned in this act willfully violates any of the provisions thereof, he shall be deemed guilty of a misdemeanor, and upon conviction thereof in any justice's court having competent jurisdiction, shall be fined not less than fifty nor more than one hundred dollars for each offence.

Sec. 7. It shall be the duty of all municipal corporations and county authorities in this State to provide for the extermination of said Canada thistle within the limits of such corporation or on the vacant lands within such county, and any city or town corporation within this State neglecting or refusing to comply with the provisions of this section shall be liable to a forfeiture to the State of a sum not less than fifty nor more than five hundred dollars, to be recovered by suit in the name of the State in any court of competent jurisdiction.

Sec. 8. It shall be the duty of the several district attorneys of this State to prosecute all suits brought under the provisions of section 7 within their respective counties, and such attorneys shall be entitled to a fee of twenty-five dollars for every judgment rendered in favor of the State in such suits, and shall be entitled to a fee of ten dollars for every suit brought under the provisions of this Act when judgment is rendered against the State.

Sec. 9. Inasmuch as there is urgent need for the immediate extirpation of this weed, this Act shall take effect upon its approval by the Governor.

Session Laws of Oregon 1889, pp. 70-72.

LAW AGAINST DAGGER COCKLE-BUR.

An act for the Destruction of the Dagger Cockle-bur:

Sec. 4208. It shall be the duty of the supervisors of the several counties in this state in addition to the duties hitherto prescribed by law, to cause the destruction of in the manner which to said supervisors shall seem most effective, of the weed known as the dagger cockle-bur, where such weed shall be found growing upon the public highways and county roads of this state.

Sec. 4209. The road supervisor shall have the the power to warn out laborers upon the public highways for the extirpation of said weed, as in cases of repairs of such highways.

Sec. 4210. Any road supervisor neglecting to perform his duty under the provisions of this chapter shall be liable to a fine of not more than twenty-five nor less than five dollars, to be recovered to the use of the county before any justice of the peace by suit in the name of the county.

Sec. 4211. The owners or occupants of lands shall carefully extirpate such weed when the same is found growing upon the land of such owner or occupant; and if such owner or occupant shall fail or refuse to destroy such weed after being notified by the road supervisor or any other person of the existance of such weed upon his land, then it shall be the duty of the road supervisor to cause said weed to be destroyed upon said land, and at the expense of the owner thereof, the expense of such labor in destroying such weed to be recovered by suit in the name of the county before any court of competent jurisdiction.

Sec. 4212 It shall be the duty of municipal corporations and county authorities in this state to provide for the extermination of the said dagger cockle-bur within the limits of such corporation, or on the vacant lands within such county, and any city or town corporation within this state neglecting or refusing to comply with the provisions of this section shall be liable to a forfeiture to the state of a sum not less than fifty nor more than five hundred dollars, to be recovered by suit in the name of the state in any court of competent jurisdiction.

Sec. 4213. It shall be the duty of the several district attorneys of this state to prosecute all suits brought under the provisions of section 4212 within their respective counties, and such attorneys shall be entitled to a fee of twenty-five dollars for every judgment rendered in favor of the state in such suits, and shall be entitled to a fee of ten dollars for every suit brought under the provisions of this chapter when judgment is rendered against the state.

Chapter 82 Hill's Annotated laws of the State of Oregon.

HOW TO DESTROY WEEDS.

It is difficult to give methods of weed destruction that will prove applicable to the whole state as what would be effective here might not be practicable elsewhere. The treatment varies with the soil, climate and nature of the plant but some general rules may be given.

Annuals, that is plants living only one year, have herbaceous fibrous roots and can easily be destroyed by keeping them mown down or by plowing them under thus enriching the soil. Sometimes seeds already in the



SOW THISTLE. (*S. oleracea*, *L.*)

ground remain there for a long time without germinating, if the conditions are unfavorable, but a little care for a few years in removing all plants before any of the seeds ripen will gradually rid a farm of them.

Biennials, live two years storing up food the first season and fruiting the next, have thick fleshy roots and may be destroyed in the same way as annuals.

Perennials, that is plants living for several years fruiting and dying down each fall to come up again with renewed vigor in the spring, have woody roots and are more difficult to dispose of. If however they are kept cut close to the ground and not allowed to develop their leaves, which have been compared to the lungs of animals, they become weakened, the other plants get a start and choke them out.

Weeds in places where they are not too numerous, as in lawns, meadows etc., may be killed by placing a handful of salt on the crown, early in the season, preferably just after the grass has been cut. Kerosene, strong brine, gas lime, naptha, and sulphuric acid used similarly have been recommended. Pulling weeds up root and branch or digging them out with the trowel and spade is very effective and well worth the trouble in the case of bad weeds.

In attempting to rid a field of weeds do not forget those growing in the fence corners, on the banks of ditches, and along roadsides. This will improve the appearance of your fields, increase their value, and prevent seed from being scattered over the farm by the wind. Begin the work of destruction early as it will then prove much easier. It must be done early enough to kill the weeds before the seeds begin to ripen Keep the fields free from all weeds Mark well where weed patches are and examine those parts of the field from time to time and if any weeds are found remove them immediately.

Cutting when in flower will kill many weeds. Thistles, Tarweed and other members of the Sunflower family, (*Compositæ*) if cut while in bloom *should be burned immediately* else the seed will ripen on the ground and be distributed by the wind.

Cultivation in a dry time is most injurious to weeds and beneficial to growing crops if their roots are not injured. After a summer crop has ripened sow some crop to cover the ground and keep weeds down. Give clean cultivaton every few years either with a hoed crop or a fallow. Keep the ground well occupied with crops. Keep meadows and roadsides well sodded and plow-land cultivated unless shaded by crops. Sedge-like weeds may be destroyed by tile draining wet meadows. Avoid the introduction of weeds in manure, litter, or from weedy surroundings.

Weeds are not only unsightly but they occupy valuable space crowding out crops from which they take moisture and nutriment, thus lessening the yield It is much easier to prevent the introduction of weeds than to destroy them when thoroughly established,—so great care should always be taken to sow clean seed, as the extra expense will be more than repaid by the increased value of the crop. Unless one can readily distinguish good pure seed from bad mixed seed he should purchase only from reliable firms.



CHINESE THISTLE.

DESCRIPTION OF THE CANADA THISTLE.

This plant differs from the common Bull Thistle, for which it is often mistaken, in its slenderer wingless stem and branches, in the thin narrow (½ to ¾ inch), curled and more deeply cut leaves, less rigid prickles, and smaller flower heads which are about half an inch in diameter.

It is more difficult to destroy than the common thistle as it is a perennial spreading by long underground stems, which penetrate deeply into the soil, often below the reach of the plow. These rhizomes extend horizontally in all directions and being furnished with buds send branches to the surface where a tuft of leaves is first produced followed later by ærial stems which bear flowers and seed. These die down to the ground every fall, but in the spring the rhizomes again send up numerous branches which soon cover the ground, the plants spreading with surprising rapidity from year to year.

This "Cursed Thistle" is also propagated by seeds which supported by the downy pappus are often carried long distances by the wind. Like most of our troublesome weeds it was introduced from Europe and has now become permanently established in this country. It has been reported from nine counties in Oregon where fortunately it is not abundant.

Cnicus arvensis, Hoffm. Fl. Germ. IV. 180—Perennial and spreading by creeping root-stalks a foot or two high, corymbosely branching, usually glabrate and green: stem and branches wingless: leaves lanceolate, pinnatifid and toothed, furnished with abundant weak prickles: heads loosely cymose, less than an inch high, dicœcious; in male plant ovate-globular, and flowers (rose-purple) well exserted; in female oblong-campanulate and flowers less projecting: bracts of involucre all appressed, short, and with very small weak prickly points: only abortive anthers to the female flowers. Meadows, pastures, and waste grounds, from Newfoundland through the Northern and Middle Atlantic States: a too common weed. (Nat. from Eu.)

HOW TO DESTROY CANADA THISTLES.

Frequent deep plowing will in shallow, dry soils nearly always destroy the thistle, but in light, rich, moist soils this usually fails. Wherever a dense sod can be formed seeding will be found the easiest means of destruction, though not so rapid as plowing, hoeing, salting, or burning where these means are available. On rich bottom lands or in ground filled with stumps, a grass sod will be found the best destroyer. If the land is not rich enough to form a good sod manure it.

Mowing when the thistle is coming into bloom does not destroy the plant though it checks its growth. The application of kerosene or strong brine to the roots, after cutting off the tops three or four inches below the crown with a spade, is effective and practicable in small patches. In stony ground the scythe, salt, and sheep will be found good destroying agents. If the thistles are in fence rows move the fence and plow.

One object of thorough cultivation is that all weed seeds may germinate and be destroyed at once and not lie dormant in the ground coming up a few at a time to reseed the field. Plowing and stirring the soil when infested with Canada thistles unless thoroughly done, only multiplies them, so do not permit any leaves or underground stems to remain, but burn the plants immediately after cutting. The cultivation need not be deep. If all the thistles are kept cut off three inches below the surface the underground portions will soon die of exhaustion.

DESCRIPTION OF THE BULL THISTLE.

This common weed is very abundant in pastures and along roadsides throughout the state, flourishing in rich moist soil. It is a biennial producing the first year simply a tuft of large spiny leaves spread out flat upon the ground; the second year it sends up a stout, erect, branched stalk, two to four feet high, blooms, bears seed and dies. The plant is propagated by seeds which supported by the spreading pappus are carried long distances by the wind and scattered far and wide.



SEED OF BULL THISTLE.

It may be distinguished from the Canada thistle by the larger flower heads (1 to 1½ inches in diameter) and the wider (1½ to 2 inches) stemless leaves cobwebby beneath with margins running down the stem as ragged wings which make the stalk very prickly.

The bull thistle is easily killed by keeping it cut just below the surface of the ground. Mowing the thistles three or four times a year will kill many of them but enough plants are always left to reseed the patch. Thorough work for two years followed by watchful care will rid a farm of this pest.

Cnicus lanceolatus. Hoffm. Spec. III. 1666. Biennial, 3 or 4 feet high, with large heads (almost 2 inches high) terminating somewhat leafy branchlets, cottony tomentose when young becoming green, more or less villous or hirsute: leaves lanceolate, deeply pinnatifid and with lanceolate lobes, rigidly prickly; upper face strigose-setulose; base decurrent on the stem into interrupted prickly wings; bracts of involucre arachnoid-woolly, lanceolate and mostly attenuate into slender and rigid prickly-pointed spreading tips: flowers rose-purple, hermaphrodite. Pastures and waste grounds, Newfoundland and Canada to Georgia (very common northward); also in Oregon. (Nat. from Eu.)

THE SOW THISTLE.

There are two species of this so called thistle in the state; one an easily killed annual, the other an aggressive weed difficult to destroy when once established but fortunately rare.

The first species (known to botanists as *Sonchus oleraceus*, L.) is abundant in many parts of the state. When growing in gardens and small

patches it may be extirpated by clean culture or by pulling the plants up when the ground is wet and soft as it frequently is in western Oregon. Large patches may be treated as follows: Cut the plants just before blooming with a scythe or mowing machine, carefully cleaning out all fence corners, ditches, etc., then rake into heaps and burn as soon as possible to prevent seed ripening and becoming scattered.

The other species (*S. arvensis*, L.) is a perennial distinguished from the above, which it resembles, by its creeping rootstalks. The hollow, angular stems, which grow about two feet high, are softer and less rigid than those of the true thistles. Prickles are borne only on the margins of the deeply cut leaves which are thinner and smoother than those of the Canada and bull thistles. The leaves are more curled than in the bull thistle but less than in the Canada thistle. Large heads of bright yellow flowers are produced at the ends of the branches.

It spreads like the Canada thistle, by creeping rootstocks, so cutting the plant before the flowers open does not destroy this plant though it checks the growth and prevents seeding.

Thorough cultivation and grubbing out the roots is practicable in small patches but when they are numerous and large the summer fallow is easier, and if properly done, as effective.

Sonchus arvensis, L. Rootstocks creeping: stems 2 feet high, naked at summit, bearing few or several and corymbosely paniculate showy heads: leaves runcinate-pinnatifid or some undivided, denticulate-spinulose, cauline partly clasping at base: peduncles and involucre more or less glandular-bristly: head almost an inch high: akenes oblong, about 10-costate, rugulose on the ribs.—On shores and banks of streams, in several places in N. Atlantic States, and Salt Lake City, Utah. (Nat. from Eu.)

THE CHINESE THISTLE.

This is a coarse annual, from South America, abundant in fields and waste places along railroads in Eastern and Southern Oregon. It grows from one to three feet high with a much branched stem which bears numerous slender triple-spines at the base of the alternate leaves. These spines are a pale yellow color, about an inch long and very sharp. The leaves are white-downy beneath and taper toward both ends with a short petiole. The fertile flowers are enclosed in a bur-like, two celled involucre, armed all over with hook-tipped prickles. These burs cause great annoyance in the fleeces of sheep.

It differs from the Canada thistle, bull thistle, and sow thistle in having the spines borne on the stems instead of on the leaves; and from the Russian thistle in the long, round, needle-like spines which are never flat as in the saltwort.

This plant, which is probably the one meant in the weed law by Dagger Cockle-bur, is not likely to become very troublesome as it lives but one year and is easily killed by cutting off the top. Keep the plants from maturing seed by frequent mowing, or clean cultivation with a hoed crop, and you will soon be rid of it.

Xanthium spinosum, L. A foot or two high, much branched: leaves ovate-lanceolate with cuneate base, the larger 3-lobed or incisely pinnatifid, glabrate and green above, white-tomentose beneath: axils bearing long and

slender 3-parted yellow spines: fertile involucres solitary or few in upper axils, cylindraceous, half-inch long, obtuse, armed with short weak prickles, inconspicuously 1—2 beaked or pointless. A weed of S. Atlantic States and Pacific coasts, occasionly about sea-ports northward to Mass. (Nat. from Trop, Am.)

THE RUSSIAN THISTLE.

The Russian thistle, or Saltwort, is now awakening wide-spread interest through the country because of the damage it may cause if once established, and the ease with which it may be destroyed if proper measures are taken in time.

Prof. Dewey (to whose excellent monograph we are indebted for much here given) says the loss caused by this weed in North and South Dakota for the year 1892 was over $2.000.000. The plant is especially troublesome in wheat and flax fields.

It has not yet been reported in Oregon, but the arid parts of the state will be a congenial home to which the plants will be brought ere long in the straw and chaff used in packing goods. Thence these tumble weeds will be carried by the wind over the fields and through the valleys of our state, this distribution being aided by the immense number of seeds produced. Every farmer should be able to recognize and destroy the very first specimen that appears in his neighborhood.

The Russian thistle is an annual coming up each spring from seed sown the previous fall. When young it is a tender, innocent-looking plant with small, downy, green leaves. At first it is said to resemble a young pine in color and appearance. Later, in August, the tender leaves drop off and the plant increases rapidly in size sending out hard stiff branches which bear at intervals of half an inch clusters of three sharp spines instead of leaves. The spines are about half an inch long and borne at their base is a very small papery flower.

The stem, comes from a small root, is much branched and if not crowded forms a dense bush 2 to 6 feet in diameter and half as high. The mature plants are of a purplish color and may be distinguished from other tumble weeds by the denser growth, darker color and the clusters of sharp spines instead of flat leaves.

It may be well to give the technical description as drawn up by Prof. L. H. Dewey, since the botanies in common use do not describe this variety.

Salsola kali tragus (L.) Moq. in DC. Prod., XIII, 2, 187 (1849).—A herbaceous, annual, diffusely branching from the base, 0.5 to 1 m. (1½ to 3 feet) high and twice as broad, smooth or slightly puberulent; tap root dull white, slightly twisted near the crown; leaves alternate, sessile; those of the young plant deciduous, succulent, linear or subterete, 3 to 6 cm. (1 to 2 inches) long, spine-pointed and with narrow, denticulate, membranaceous margins near the base; leaves of the mature plant persistent, each subtending two leaf-like bracts and a flower at intervals of 2 to 10 mm. (about one-twelfth to five twelfths of an inch), rigid, narrowly ovate, often denticulate near the base, spine-pointed, usually striped with red like the branches, 6 to 10 mm. (3-12 to 5-12 of an inch) long; bracts divergent, like the leaves of the mature plant in size and form; flowers solitary and sessile, perfect, apetalous, about 10 mm. (five-twelfths of an inch) in diameter; calyx membranaceous persistent, inclosing the depressed fruit, usually rose-colored, gamosepalous, cleft nearly to the base into five unequal divisions about 4 mm. (one-sixth of an inch) long, the upper one broadest, bearing on each margin near the base a minute tuft of very slender coiled hairs, the two nearest the subtending leaf next in size, and the lateral ones narrow each with a beak-like connivent apex, and bearing midway on the back a membranaceous, striate, erose-margined horizontal wing about 2 mm. (one-twelfth of an inch) long, the upper and two lower wings much broader than the lateral ones; stamens 5, about equaling the calyx lobes; pistil simple; styles 2, slender, about 1 mm, (one twenty-fifth of an inch) long; seed 1, obconical, depressed, nearly 2 mm. one-sixteenth of an inch in di-

ameter, dull gray or green, exalbuminous, the thin seed-coat closely covering the spirally-coiled embryo; embryo, green, slender, about 12 mm. one-half inch long, when uncoiled, with two linear subterete cotyledons. The plant flowers in July or August and the seeds mature in September and October. At maturity the action of the wind causes the root to break with a somewhat spiral fracture at the surface of the frozen ground and the plant is blown about as a tumbleweed. The mature flower with the enclosed seed is held in place in the axils of the bracts by the two minute tufts of coiled hairs, preventing the seeds from falling all at once when the plant begins to roll.

The variety *tragus* differs from the typical form of *Salsola kali*, which is common along the Atlantic coast, in the following characters: The leaves of the mature plant are very little longer than the leaf-like bracts which they subtend, while in the typical form of the species they are generally two or four times as long. the calyx is membranaceous and nearly always bright rose-colored, and wings on the back of the calyx lobes are much larger than the ascending lobes, while in the typical form the calyx is coriaceous and usually dull white or only slightly rose-colored, and the wings are thick, comparatively narow, and less prominent than the ascending lobes, The species itself is less bushy in habit and less rigid at maturity. It has been known along the Atlantic coast from Massachusetts to Georgia for nearly a century and has never developed into a troublesome weed.

The Russian thistle is easily killed by cutting it off at the surface of the ground with a hoe, in June or July, as the single tap root will not sprout again. When a field has become seeded it may be cleaned by repeated plowing in July or August, carefully covering all weeds with the harrow. Infested grain fields should be harvested early to avoid trouble in handling the crop. Plowing immediately after harvest will destroy many plants. Burning over stubble fields soon after harvest is good. Care should be taken to prevent threshing machines from carrying the seed to new localities. For spring grain the ground should be prepared and sown as early as possible.

Every weed destroyed will lessen the work of another season. The plants should be destroyed before they begin to roll and tumble about scattering seed, piling up against shrubs and fences breaking them and increasing the danger from fire. Mowing them is not always effective as the thistles often send out branches below where the machine cuts them. Pasturing sheep on the young plants will keep them down or they may be choked out by forming a dense sod. The seeds ripen about the 1st of September, and all plants pulled later should be burned immediately. Fortunately the seeds will not remain long in the soil without germinating. Clean culture should be given hoed crops until after the middle of August, as thistles starting so late will not have time to mature seed.

We can not help quoting the words of Director W. H. Hays, of the Minn. Station: "An individual can not deal with this foe. * * * The power of the government * * * must be brought into use before the pest has spread from the present comparatively small infested areas to the entire country. And if the state * * * * compels one man to prevent this weed from spreading from his lands, it assumes the responsibility of compelling every other land owner to likewise keep it in check, that he who complies with the law may accomplish his purpose, and not merely spend labor and money and have the weed again come on his fields from surrounding lands."

ACKNOWLEDGMENTS.

In preparing this bulletin we have consulted many sources of information for descriptions and methods of destroying the above plants, which owing to limited space cannot be mentioned here. Among the most impor-

tant were the reports and bulletins of the U. S. Dept. of Agriculture and of the Experiment Stations, Darlington's "American Weeds," and Gray's "Synoptical Flora."

All the half-tone engravings, were made in our Department of Photo-engraving by Prof. E. F. Pernot, to whom I desire to express my obligations for the excellent manner in which he has shown the characteristics of each plant. The electrotypes of the Bull thistle are from the Dept. of Agriculture at Washington. Our thanks are also due to Prof. L. H. Pammel of the Iowa Station for a cut of the Russian thistle, specimens of which we were unable to secure in this state.

HOW TO SEND PLANTS FOR IDENTIFICATION.

Remember that the Station was established for your benefit and if at any time you desire information concerning weeds growing on your farm or along the roadsides, or if a plant disease attacks your crops write to the Station about it and we will help you all we can.

All questions regarding plants should when possible be accompanied by specimens. These should be complete, as fragmentary or imperfect ones cause delay and errors in determination. Good specimens include flowers, fruit, leaves, and if herbaceous a portion of the root. Send plenty of material.

Plants may be preserved by drying them under pressure between folds of absorbent paper changing the dryers daily for four or five days. Protect from breakage by enclosing them between pieces of pasteboard. When sent fresh they should be moistened slightly and well wrapped in heavy paper. Number the specimens, wrapping each species separately and send in an unsealed package, with your name and address, preceded by the word *from*, plainly written on the outside. Postage one cent an ounce. In the accompanying letter refer to the specimens by number, stating the time and place of collection with such other information as you consider of interest.

We have endeavored to select and place in a brief, accessible, and it is hoped not too technical a form what is now known about the above plants. The plates will enable readers to readily recognize the species described.

Constant vigilance with intelligent action on the part of cultivators and husbandmen is necesary to keep their farms free from weeds but if the thorough work of destruction here recommended is persisted in for several years the labor will then become slight.

Let us keep out the Canada and Russian thistle that now threaten us and which if not excluded will cost the state much more in the next decade than the comparatively slight cost of destroying them on their first appearance.

Address all communications relating to plants to

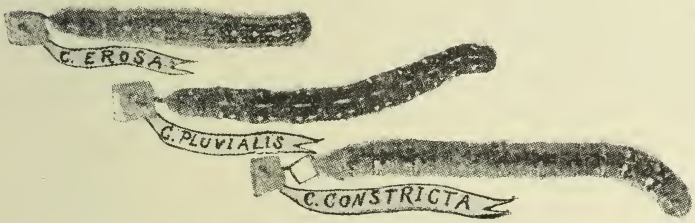
MOSES CRAIG, Botanist,
Experiment Station, Corvallis, Oregon.



RUSSIAN THISTLE.

Oregon Agricultural Experiment Station

Bulletin No. 33. December, 1894.



ENTOMOLOGY.

I. Tent Caterpillars.
II. The Grain Plant Louse.
III. The Pear Leaf Blister.
IV. The Clover Mite.
V. Koebele's Resin Wash.

The Bulletins of this Station are sent free to all residents of Oregon who request them.

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Tent Caterpillars.

F. L. WASHBURN.

Three forms of tent caterpillars have been abundant in the Willammette Valley during the past season, *Clisiocampa erosa*, *Clisiocampa plurialis*, and *Clisiocampa constricta*. The first named feeds upon almost everything but the pear, viz upon apple, quince, cherry, prune, rose and privet. The second has not been nearly as numerous as *C. erosa*, about one of *pluvialis* to every one hundred of *erosa* representng their proportionate abundance. *C. constricta* devastated whole groves of oak, particularly *Quercus Garryana*, and though they occasionally migrated to the prune tree, thereby cansing considerable alarm among orchardists, they have nowhere injured fruit trees. Experiments with this oak tree form in the entomological laboratory, demostrate the fact that they will not eat the leaves of apple, plum, or prune.

These three forms are figured on the front page of this bulletin with the appropriate label attached to each.

DESCRIPTION, LIFE HISTORY, ETC.

The life history of the group known as "Tent Caterpillars" has been described in a previous bulletin. These larvae transform into brownish or cream colored moths, about one inch long, the females of which lay their eggs in a band around twigs on their several food plants. These eggs, in case of the first two forms, are covered with a slate colored gelatinous cement, which hardens as soon as deposited, and constitues the first food of the newly hatched larva. The egg bands of *C. constricta*, however, are whitish.

The moths are on the wing during July and August and deposit a new batch of eggs. These eggs however, do not hatch until the following season, as has been determined by observations here, and therefore we need only look for one brood, though irregularity in time of hatching of the eggs cause the visitation to extend throughout the summer.

I append a popular description of each form, which will doubtless, be intelligible to all.

C. errosa. Whitish, irregularly oval spots on middle of back on all but the first few segments. On either side of these spots, and somewhat separated from them is a broad blue band bordered on either side by a brick red line. Below that, on either side, and reaching to the legs is a bluish space, characterized by one blackish dot on each segment marking the position of spiracles or "breathing holes". Below, the caterpiller is dark blue with oval black spots in median line on all but first few segments. Over the whole caterpillar are numerous fine yellowish or cream colored hairs.

C. pluvalis. The oval whitish dots of *C. erosa* replaced by linear blue spots on all but first few and last three segments, each bordered by black, and outside of that a mass of yellow broken into by black spaces, each black space being marked by two blue dots. Below this on either side is a broken line of yellow, running from one end to the other, and between this and the feet a space with mottled yellow and black coloring. Below, black and irregular blotches of white on each segment. The caterpillar is covered with long deep yellow hairs coarser and more frequent than the hairs in *C. erosa.* On account of these yellow hairs and the preponderance of yellow in the body, this caterpillar is easily distinguished from the foregoing.

C, constricta: A broad, broken, yellow and black line down middle of back, the line broken by constrictions, forming two irregular quadrangular spaces on each segment. Below this on either side of the caterpillar, a wide blue area containing numerous black spots which are bounded by yellow. Below, on ventral side, a nearly uniform black with indications of light spots in many of the segments. The caterpillars are sparingly covered with yellow and black hairs. This species presents a decidedly blue appearence.

NATURAL ENEMIES.

But few of our birds are tempted by these hairy larvae, but I have observed in a badly infested orchard a flock of Brewer's blackbirds, very common with us, greedily tearing open the cocoons and feeding on the soft pupae within. All three species are attacked by a Tachina parasite which lays eggs on, or in the vicinity of, the head, and its larva, when hatched from the eggs

bores into and feeds upon the caterpillar's tissues thus eventually killing its host, that is, the caterpillar never transforms to a moth.

Some fungus disease induced by warm wet weather appears disastrious to them, to *C. constricta* at least, for the writer has found them in June, dying and decaying by the hundreds along fences in the neighborhood of oak trees. Chalcid parasites, too, deposit their tiny eggs in these pests and emerge in numbers from the cocoons.

ARTIFICIAL REMEDIES AND METHODS OF PREVENTION.

This subject has been thoroughly discussed in previous bulletins.

Spraying with the arsenites, for the codling moth poisons the leaves and hence kills the leaf-eating caterpillar. Their nests or "tents" with contents, when small and within reach, can be crushed by the hand, and when larger or out of reach can be burned by the application of a torch. It is a noticeable fact that these forms are not so prone to manufacture elaborate nests as the eastern form, *C. americana*. They are frequently found massed on the side of a limb or trunk, thus offering an opportunity to easily kill a large number by the use of a flat stick, piece of shingle or the like.

On the principle, however, that an "ounce of prevention is worth a pound of cure" the most efficacious way of disposing of them is to destroy the egg masses found on twigs in Autumn and Winter, by burning. This may be accomplished by cutting off the twigs upon which the eggs are found and consigning them to the fire; or better, in order to avoid the excessive pruning of small trees which this will entail, break the egg masses, slip them off the twigs and then destroy them. It requires a careful search, or better, several careful searchings to find all the egg masses, but it is by far the most advisable method of proceedure.

The above methods apply to the two forms which infest fruit trees. It would be hardly feasible to practice it against the oak tree form. It is probable, from the large number of diseased individuals of this latter species observed and empty cocoons found that their numbers next year will be very markedly lessened, but from the number of egg masses of *C. erosa* and *C. pluvalis* which can now be seen, it would appear that we may expect them again the coming season.

The Grain Plant Louse.--*Siphonophora avenae,* Fab.

F. L. WASHBURN.

Almost all of the wheat growing districts in Oregon have been more or less affected this year with the Grain Aphis or Grain Plant Louse, causing the farmer no little anxiety. Many had never before seen anything like it, and were loth to believe that to the grain had come a pest which they were practically powerless to successfully combat. It attacked wheat, oats and rye, and the writer found it on a form of mesquit grass within two miles of the sea-coast, far from any grain field.

Grain badly infested, invariably shrivelled, and millers inform me that its effect is easily seen in the fact that much of the marketed wheat is of an inferior quality.

It is probable that this pest was in the state in limited numbers last year, bnt unnoticed, and the marvellous rapidity with which new individuals are produced will account for the seemingly miraculous invasion. Prof. Fitch, State Entomologist of New York, has proved, by actual experiment, that the females of the grain aphis begin to produce living young when three days old, at the rate of four a day; hence, in three weeks time, eliminating all unfavorable conditions, the descendents from one mother amount to nearly or quite two millions.

The insect is greenish in color, attacking the stalks, and later the heads of wheat, rye, and oats. It has a large beak with which it extracts the sap. This absorption of the sap is what injures the berry. As wheat ripens it migrates to the more succulent oats and when these ripen it goes to the various grasses. It spreads over a wide extent of territory quicker than any insect known.

On the back of the last page of this bulletin is a photograph of some wheat heads badly infested with this pest.

ITS HISTORY.

Although its existence was observed seventeen years before, the grain aphis first appeared in great numbers in 1861, spreading over New England, all of New York except the western portion, northeastern Pennsylvania and portions of Canada. Every grain field was invaded and many of them thronged. In many cases the wheat crop was reduced one-half, and the oat crop hardly paid for harvesting. The following year it spread over the re-

maining portion of Canada and into Michigan, and then disappeared. In 1883 it appeared in ten counties in California doing considerable damage to wheat, one man reporting that the yield of his spring wheat was diminished one-half by the ravages of the pest. April 29th and 30th and May 2nd and 3rd large flights of the winged variety were noticed in Sacramento, but disappeared after the rains of May 4th. In nearly every instance where the pest has appeared it has been met by a host of parasitical and predaceous insects

ARTIFICIAL REMEDIES.

From the nature of the circumstances, the farmer can himself do little or nothing against this pest. It may do no harm to suggest the following measures the value and practiability of which are questionable. 1. Burning the stubble immediately after harvest together with all straw, weeds, litter, waste, etc. on or about the field. 2. Cultivating the land after the crop has been harvested, removing all grass and weeds from around the edge of the field, and growing no grass or grain crop on that piece of land next year. 3. *Wheat and oats which are so badly infested in the green that they very evidently will not ripen can be cut for hay with advantage, Such hay is perfectly acceptable to stock.*

NATURAL ENEMIES.

Under the head of natural enemies occur the "Lady Beetle," or "Lady Bugs" as they are called, Syrphus Flies, "Aphis Lions" and the numerous minute flies which are parasitic on plant lice.

Fortunately, almost simultaneously with an outbreak of this pest appear myriads of these their foes, and as the beneficial forms multiply very rapidly, they greatly reduce the numbers of the lice. It is to these we must look for help, in this crisis and they are about all we can rely upon to lessen the evil. Whenever the aphis turns a dark color, either brown or black, it means that it is doomed. For this is caused by the aphis parasite which deposits its egg on or within the aphis. The egg hatches and the larva feeds on the tissues of the louse causing the death of the latter while the larva turns into a parasitic fly within the aphis. The accompaning illustration represents one of these parasites, about one-eight of an inch long, which has issued from the body of the louse beside it. From the body of the other aphis protrudes the head of a second fly on the point of emerging.



Parasites [*Aphidius*] emerging from dead Grain Aphids. much enlarged. From a photograph.

As far as personal examination has led me, the species of Lady Beetle attacking this pest is *Hippodamia convergens*. If one goes into an infested field and is on the alert to observe, he will see many of the above; besides varions kinds of Syrphus Flies darting from one wheat head to another, depositing their eggs among the lice. Their worm-like larvae, greenish or brownish, can be counted by the score, snugly ensconced among the aphids and rapidly picking them up and sucking their juices.

I quote from a report by Prof. A. L. Cook, formerly of Michigan, dated July 10th 1889, in order to more fully demonstrate the great value of these insects to the agriculturist. Prof. Cook says: "Ten days ago, June 30th, the heads of wheat were crowded with hungry aphids or plant lice. These myriad lice, often five or six around a single kernel of wheat, and two hundred on a single head, were sucking the sap and very vitality from the forming kernels. They were rapidly blighting the grain, and unless some friendly hand were raised against them

the wheat crop would be utterly ruined. Even then, when the lice were countless in number, and when the winged forms were rapidly spreading to the oat fields, the hand of deliverance was discerned in the comparatively few but wonderfully prolific enemies of the lice which had already sounded a halt in the march of destruction. A week later and the enemies of the lice were in the ascendancy, and to-day the lice are nearly exterminated, the wheat crop rescued and the oat crop saved. Close observation easily demonstrates these truths. Even the careless eye can see the savage insects dining on the lice, or the fatal egg laid which dooms the larva which receives it." It would appear that excessively wet or excessively dry and hot weather is unfavorable for the grain aphis; for in the first case much rain would chill or kill newly born lice, as well as give the plant abundant nourishment thereby enabling it to withstand attack the better, while excessively warm and dry weather would likewise be fatal to young lice. A medium warm and damp atmosphere is most conducive to the growth and multiplication of all plant lice.

While these insects may, in one season, so reduce the numbers of the Grain Plant Louse, that its attack the following year is hardly appreciable, it may rally sufficiently to cause some injury the second season. Therefore, although there may be no visitation the coming year, it is quite possible its ravages may be felt, after which, if our little friends the Lady Beetles etc., do good work we may expect immunity for many years.

The Pear Leaf Blister.

F. L. WASHBURN.

This affection of the pear leaf is caused by a minute mite, *Phytoptus pyri*, and is probably more common, and has been here longer, than most orchardists realize; in fact, it is very likely that much of that which has been called "blight" on the pear by casual observers, is really the work of this pest. The mite is very small, hardly visible to the naked eye, and is well represented in the accompanying micro-photograph furnished by Mr. Pernot.

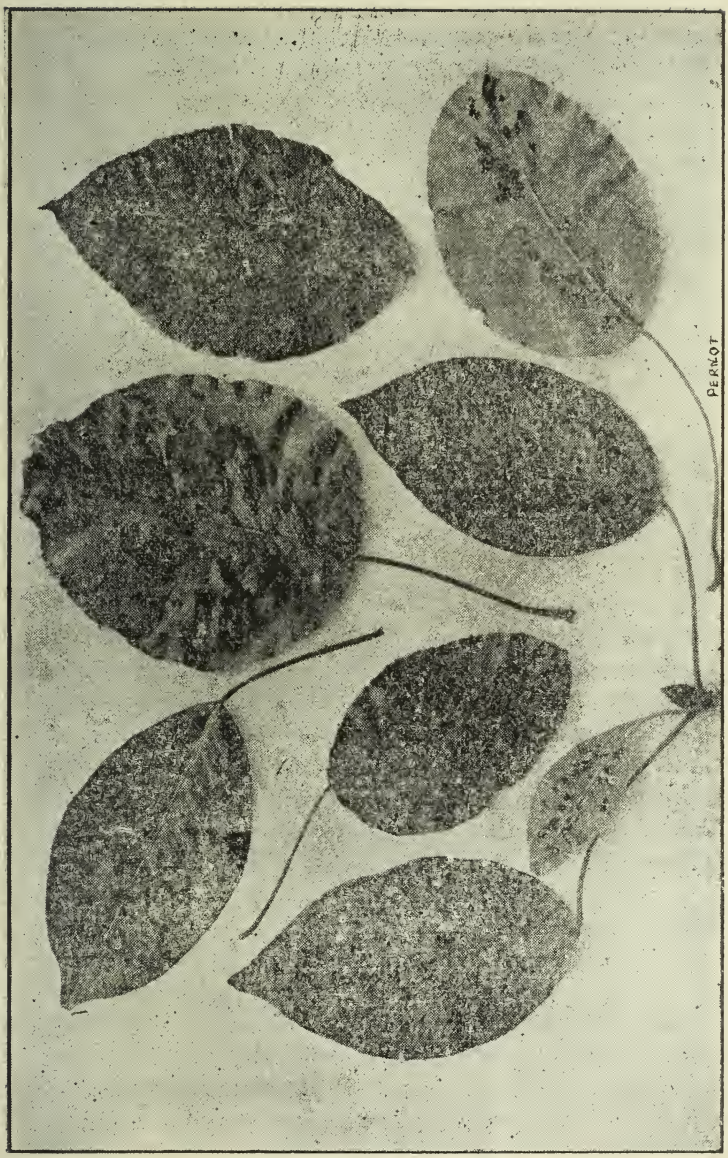


Phytoptus pyri, enlarged about 300 times.

It attacks both sides of the leaf, but individuals are more numerous on the under side where the small "blisters" can be seen with the naked eye. A lense, however, is required to show the opening in the centre of the blister which serves as a doorway for the mite. The location of the injury below is made apparent on the upper surface of the leaf, by an irregular reddish spot, (in the early stages) which changes later to brown and black, while the tissue of the leaf between these two points, in which tissue eggs and young mites are found, becomes corky and dies.

The injury to the tree is more readily seen in the middle and late summer, when, in bad cases, almost its entire foliage looks blighted.

The young mites when hatched spread from leaf to leaf, creating new blisters and thus bringing about the condition referred to above. In the autumn when leaves begin to wither and fall, the mites migrate to the twigs and hibernate beneath scales of bark or bud in the minute crevices on twigs, and in the spring they are fully open. It is hardly necessary to say that this mite saps the vitality of the tree, and interferes with the natural functions of the leaves. The work of this pest is illustrated by the accompanying full page plate, showing views of upper and lower surfaces of leaves.


PERROT

REMEDIES.

When a tree is observed to be first attacked, pick off and burn the infected leaves. Heavy pruning and burning the cuttings of such trees as are badly affected, during the winter will probably be more efficacious than anything else. One or two sprayings of kerosene emulsion in the autumn when mites are migrating would destroy many. The same spray, used several times, has been recommended for winter use. It is highly spoken of in a Cornell University bulletin, and is to be used in this proportion,—one part emulsion to seven or eight parts of water.

The Clover Mite.

Bryobia pratensis.—Garman.

F. L. WASHBURN.

It is now evident that this pest is more prevalent in Oregon than is generally supposed. No complaints having been received from growers of clover, the Entomologist has referred specimens of eggs and young mites sent him to the species known as the Red Spider with which this mite is almost identical. But, suspecting from its abundance, that it might be Bryobia, specimens have been recently sent to specialists at Washington D. C. and our suspicions confirmed. The young Clover Mite resembles so closely the young of the so called Red Spider that only specialists in this branch of entomology can satisfactorily determine the difference.

The two belong to the same family, *Tetranychidæ*, and have been for a long time confused. Like the Red Spider, the Clover Mite feeds on plant tissues, infesting almost all kinds of fruit trees, though red clover is said to be its principal food plant. When attacked the leaves of clover look sickly as if suffering from some fungus. It is also found on some grasses and has been known to occur in houses. It was first reported from this coast (California) as early as 1879. May 28, 1889, Mr. E. Shipley of James Val-

ley P. O., Oregon sent specimens of this mite to Washington D. C. with the statement that it was abundant on boards, stones, fences and fruit trees. It has been found on Apple, Pear, Plum, Prune, Poplar, Elm, Peach, and Almond.

In some localities young mites are found with the eggs during the entire winter season. These eggs are red or reddish, easily seen with the naked eye, and are laid in masses on the bark or beneath the scaly bark of old trees. In the winter they are found by the hundred in protected situations.

When attacking forage crops, it cannot, with our present knowledge, be combatted. When on fruit trees, the Department recommends spraying with kerosene emulsion to which a little sulphur has been added, and when infesting houses the same solution should be used on the lawn and outside walls of the house.

As stated before, no complaint of this pest with regard to clover has been received at our Station. If, at any time, the clover crop should appear to be suffering from the attacks of this mite, the Entomologist would like to be advised of the fact, and to receive specimens of the mite and its work.

Koebele's Resin Wash.

F. L. WASHBURN.

During Mr Kœbele's last visit to Oregon he made, in the Entomological laboratory, some resin wash according to the following recipe: Resin 4lbs., Carbonate of Soda (common washing soda) 3lbs., water 1 gallon; boil together until all the resin is dissolved and then add gradually four gallons of warm water, stirring all the time, and continue the boiling until the mixture is the color of molasses. He recommended its use as follows: for Woolly Aphis 1 part of wash to 6 parts of water, for any other Aphis 1 part wash to 10 or 12 parts of water, for Mealy Bug 1 part of wash to 10 or 12 parts of water.

We have had occasion since then to make and use this wash

and feel able to indorse all that Mr Koeblelc says in its praises when used against different forms of plant lice.

During his investigations in the hop fields of this state, it was his aim to show the growers the virtues of this wash, claiming it was in many respects better than kerosene emulsion or quassia chips though he by no means denied the efficacy of the last two.

It was his idea that this wash could be used at such a strength that it would kill all the lice and yet not injure the beneficial forms of insects found amongst and feeding on the former. It was a suggestion from him which prompted the Entomologist to begin a series of experiments in this direction. The following is to be regarded as only a preliminary report on this work.

Winged and wingless hop lice were found on plum leaves Oct. 13th. Some of these leaves were immersed in a solution of resin wash and water, one part of the wash to thirty parts of water, for five seconds. After forty-eight hours these leaves were examined and it was found that but comparatively few lice had been killed. One part of the wash to twenty five of water gave the same results. One part wash to fifteen parts of water was then used and all the lice so treated were dead when leaves were examined a few hours later. Naturally one part of wash to ten and twelve parts water respectively was equally efficacious.

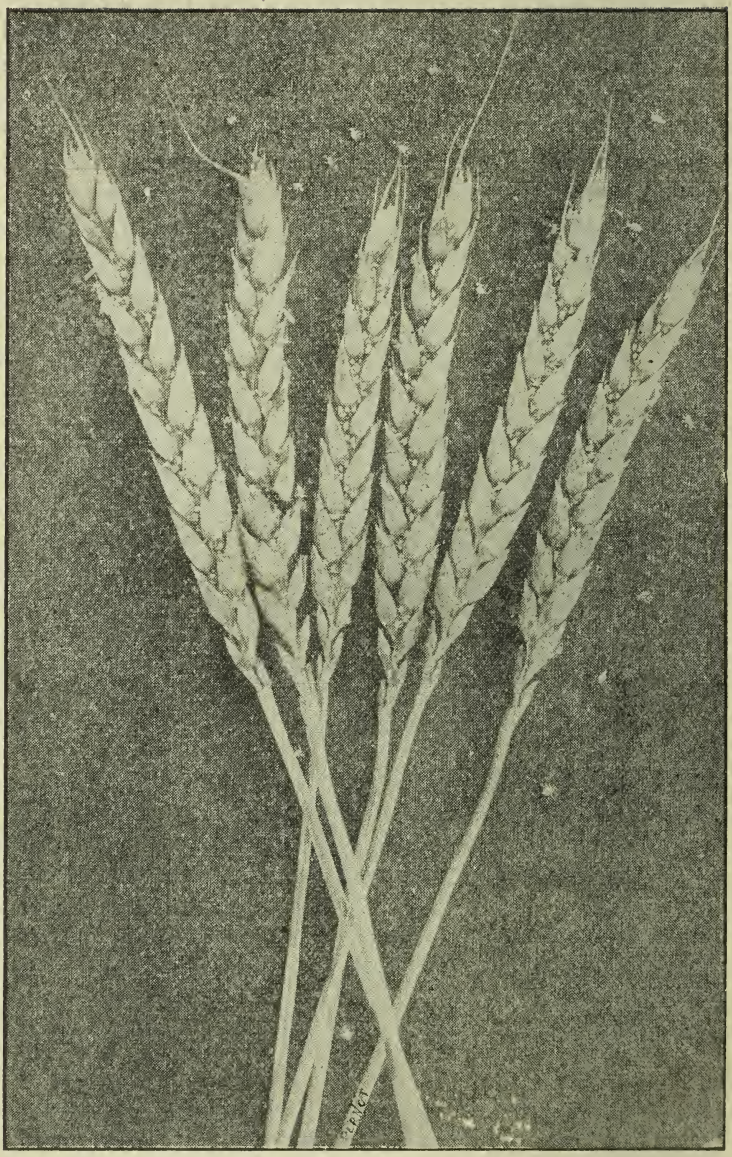
Attention was then directed to the effect of these strengths upon the predaceous insects found with hop lice. One part of the wash to fifteen of water did not effect the larvæ of Syrphus flies, and only induced a temporary disability on the part of the larvæ and imagos of the Coccinellidae "Lady Beetles". One part of the wash to eight parts of water (10-20 seconds immersion) killed both Coccinellidae larvæ and imagos but did not seriously inconvenience the Syrphus larvae, which can stand, as found later, a solution of one part of the wash to six of water, without succumbing.

It would appear, then, that one part of the wash to fifteen of water can be used against hop lice without endangering either of the above two predaceous insects in company with them.

Of course, the test in the field would not be as rigid as in the

laboratory; in other words, neither the lice nor the beneficial insect would be immersed so completely or for so long a time, by the spray. Hence one part to twelve could probably be used with safety, and perhaps with greater efficacy as far as the lice are concerned. By reference to the first part of this article it will be seen that this strength, 1 part to 10 or 12 of water, is exactly what Mr Koeblele recommends for all forms of plant lice except Woolly Aphis.

All illustrations in this bulletin have been prepared by Mr. Pernot in charge of our Photographic department



Heads of Wheat infested with Grain Plant Louse; on one head a larva of Syrphus fly can be indistinctly seen feeding on the lice.


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